HEATHKIT
CONTINUING
EDUCATION

7 PRACTICAL CIRCUITS

Individual Learning Program

In

AMATEUR RADIO

(NOVICE LICENSE)

HEATHKIT
CONTINUING
EDUCATION

Individual Learning Program

AMATEUR RADIO

(NOVICE LICENSE)

Module 7

PRACTICAL CIRCUITS

ER-3701

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

MODULE OBJECTIVES

When you complete this module, you will be able to select or identify:

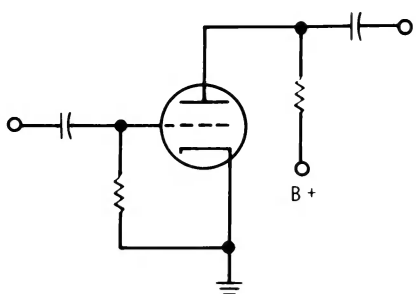
1. The schematic (diagram) of a basic amplifier circuit and recognize errors in the schematic.
2. The schematic of a basic oscillator circuit and recognize errors in the schematic.
3. The correct name and sequence of each main circuit in a simple transmitter.
4. The correct name and sequence of each main circuit in a simple receiver.
5. The purpose of a key-click filter and how to connect it.
6. The purpose of a low-pass filter.
7. The purpose of a high-pass filter.
8. The schematic of a half-wave rectifier circuit.
9. The schematic of a full-wave rectifier circuit.

MODULE PRETEST

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Pretest Answers," which follows.

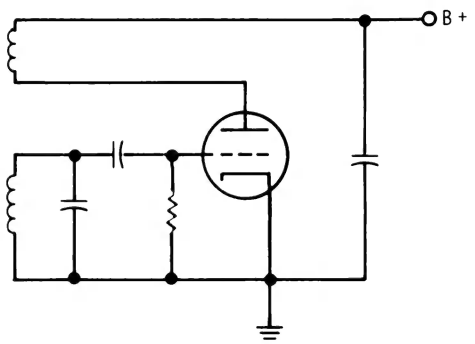
- If you miss more than two questions, read this whole module.
- If you have less than two incorrect answers, you may either study those frames pertaining to the questions you missed (the number in the parentheses, following the correct answer, refers you to the proper frame) or, you can skip this module and proceed to the next module.

1. What kind of circuit is shown below?



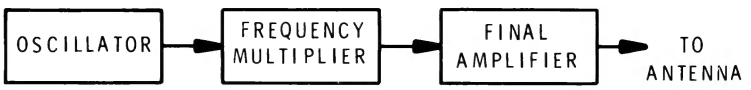
A. A low-pass filter.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A full-wave rectifier circuit.
E. A half-wave rectifier.

2. What kind of circuit is shown below?



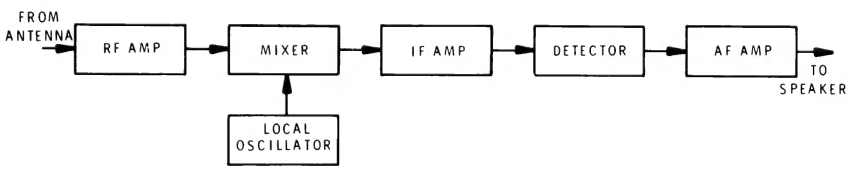
A. A basic oscilloscope circuit.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A basic amplitude circuit.
E. None of the above.

3. What does the following block diagram represent?



A. A simple transmitter.
B. A simple receiver.
C. A key-click filter.
D. A basic amplifier.
E. A low-pass filter.

4. What does the following block diagram represent?



A. A simple amplifier.
B. A simple receiver.
C. A simple transmitter.
D. A high-pass filter.
E. A simple oscillator.

5. Which of the following best describes the purpose of a key-click filter?

   A. A key-click filter is used on a receiver to remove spikes on received signals.
   B. A key-click filter is used on a receiver to remove spikes on a transmitted signal.
   C. A key-click filter is used on a transmitter to remove spikes on a received signal.
   D. A key-click filter is used on a telegraph key to remove spikes caused when you suddenly open or close a telegraph key.
   E. A key-click filter is used on the antenna to remove spikes caused when you open and close a telegraph key.

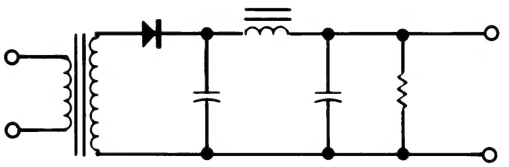
6. Which of the following statements is true concerning the purpose of a low-pass filter?

   A. The purpose of a low-pass filter is to pass signals below a certain frequency but block any higher frequency signals.
   B. The purpose of a low-pass filter is to block signals below a certain frequency but pass any higher frequency signals.
   C. The purpose of a low-pass filter is to pass signals above a certain frequency but block any lower frequency signals.
   D. All of the above are true.
   E. None of the above are true.

7. Which of the following statements is true concerning the purpose of a high-pass filter?

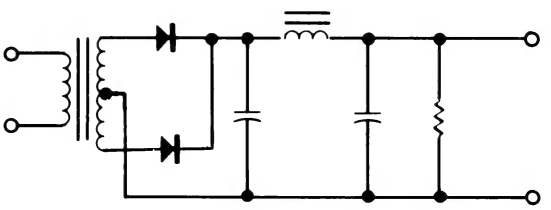
   A. The purpose of a high-pass filter is to pass signals below a certain frequency but block higher frequency signals.
   B. The purpose of a high-pass filter is to block signals above a certain frequency but pass lower frequency signals.
   C. The purpose of a high-pass filter is to pass signals above a certain frequency but block signals below this frequency.
   D. All of the above are true.
   E. None of the above are true.

8. What kind of circuit is shown below?



A. A half-wave receiver circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A basic receiver circuit.
E. A half-wave rectifier circuit.

9. What kind of circuit is shown below?



A. A half-wave rectifier circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A full-wave receiver circuit.
E. An oscillator circuit.

PRETEST ANSWERS

Q	A	FRAME NO.
1.	B	(1)
2.	C	(2)
3.	A	(4)
4.	B	(7)
5.	D	(10)
6.	A	(13)
7.	C	(16)
8.	E	(19)
9.	B	(22)

INTRODUCTION

In Module Six, you learned some of the basic symbols for several electronic components. This module will use these basic symbols to teach you the schematic diagrams of some of the basic electronic circuits. You will also learn the purpose of three different types of filters.

PROGRAMMED INSTRUCTION

1. One of the most common circuits used in electronic equipment is called an amplifier circuit. An amplifier circuit, as its name implies, amplifies (or enlarges) a signal.

   Figure 7-1 shows the schematic of a basic tube amplifier circuit.

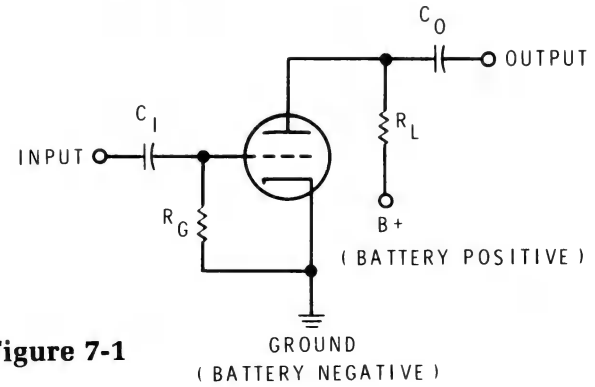
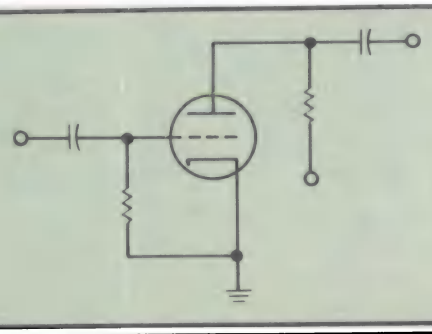


Figure 7-1

   Capacitors C_I and C_o are called input and output coupling capacitors. These capacitors allow the AC signal to pass from the previous circuit to the amplifier circuit, but yet block the DC. Resistors R_G and R_L set the operating voltages on the tube for normal operation.

   Draw the schematic of a basic tube amplifier circuit. It is not necessary to label the components.



2. An oscillator circuit is another common circuit used in electronic equipment. Oscillator circuits are used to generate an AC signal.

Figure 7-2 shows the schematic of a basic tube oscillator circuit.

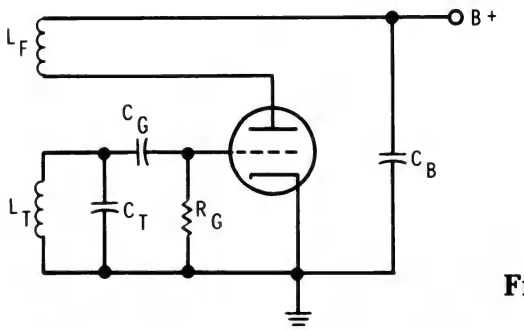
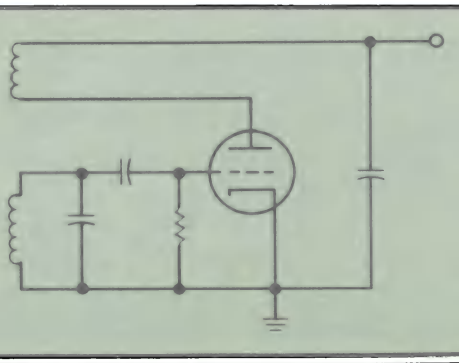


Figure 7-2

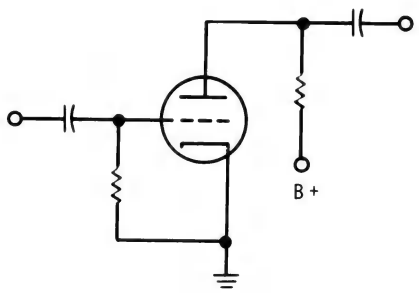
The most noticeable difference between an oscillator circuit and an amplifier circuit is the addition of a tuned circuit and some type of feedback.

Coil L_T and capacitor C_T form a tuned circuit, called a tank circuit, that will oscillate at a specific frequency. Coil L_F, the feedback loop, feeds back some of the oscillations from the plate of the tube to the tank circuit. This action keeps the oscillator running. Capacitor C_B, is a bypass capacitor which prevents the oscillations from entering the power supply (battery) circuit.

Draw the schematic of a basic tube oscillator circuit. It is not necessary to label the components.



3. What kind of circuit is shown below?



A. A basic oscilloscope circuit.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A basic amplitude circuit.
E. None of the above.

B

4. A basic novice transmitter contains an oscillator, one or more frequency multiplier stages, and a final amplifier (power amplifier) which contains tuning and loading controls.

Figure 7-3 shows the "block" diagram of a basic novice transmitter.

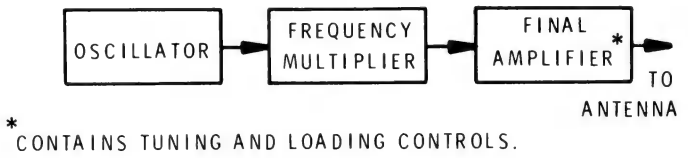
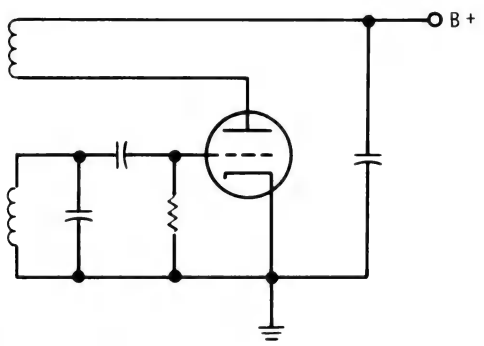


Figure 7-3

The oscillator generates the radio frequency, the frequency multiplier stage increases the oscillator frequency to the proper operating frequency, and the final amplifier boosts this signal and drives the antenna.

Draw the block diagram of a basic novice transmitter and label the blocks.

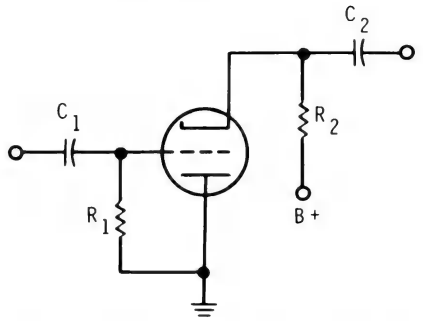
5. What kind of circuit is shown below?



A. A basic oscilloscope circuit.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A basic amplitude circuit.
E. None of the above.

C

6. What is wrong with the amplifier circuit shown below?



A. B+ is indicated at the wrong location.
B. Resistor R_1 is connected to wrong points.
C. Resistor R_2 is connected to wrong point.
D. Nothing is wrong.
E. The tube is drawn upside down.

E

7. A basic receiver contains an RF amplifier, a mixer, a local oscillator, an intermediate frequency (IF) amplifier, a detector, and an audio frequency (AF) amplifier.

Figure 7-4 shows the block diagram of a basic receiver.

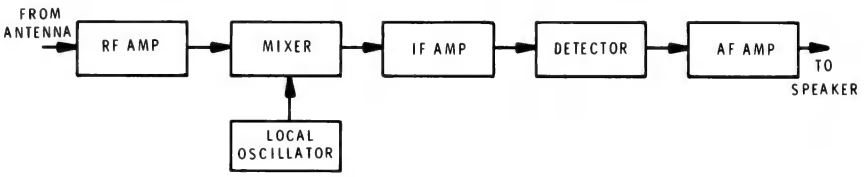
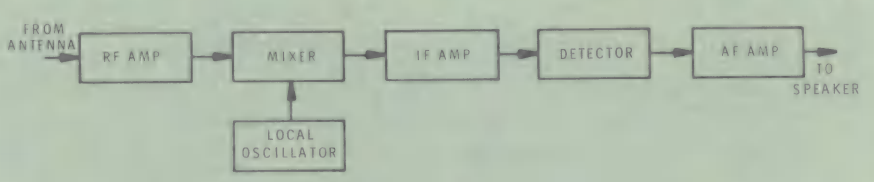


Figure 7-4

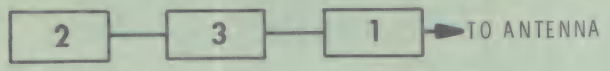
The purpose of the RF amplifier is to boost all of the incoming signals at the antenna. The local oscillator provides another signal (tunable) that is slightly different than the signals at the antenna. The mixer combines these two signals and provides a common signal frequency for use in the IF amplifier, which simply boosts the signal. The detector simply changes the IF signal to an audio (audible) signal which is amplified by the AF amplifier. The AF amplifier boosts the audio signal so that it sufficiently drives the speaker.

Draw the block diagram of a basic receiver and label the blocks.

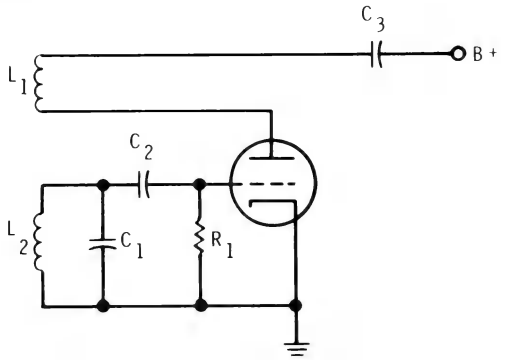


8. Write the numbers, beside the names in the right column, in the proper blocks of the transmitter block diagram shown below.

1. Final amplifier.
2. Oscillator.
3. Frequency multiplier.



9. What is wrong with the oscillator circuit shown below?



A. Capacitor C_3 is connected wrong.
B. Capacitor C_2 is connected wrong.
C. Coil L_2 is connected wrong.
D. Resistor R_1 is connected wrong.
E. The tube is drawn upside down.

A

10. The purpose of a key-click filter is to remove the spikes caused when you suddenly open or close a telegraph key.

Figure 7-5 shows a method of connecting a simple key-click filter across a telegraph key. The values given for the resistor and capacitor are typical values. This type of filter should be as close to the key as practical.

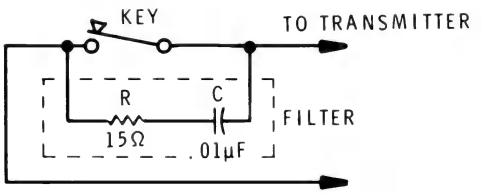


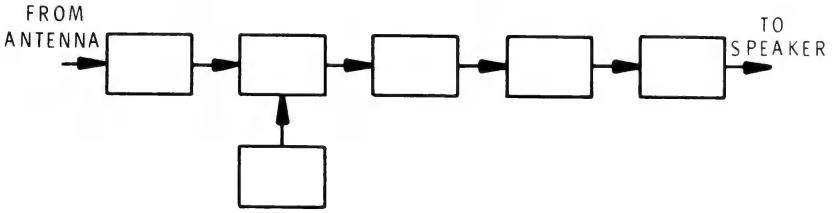
Figure 7-5

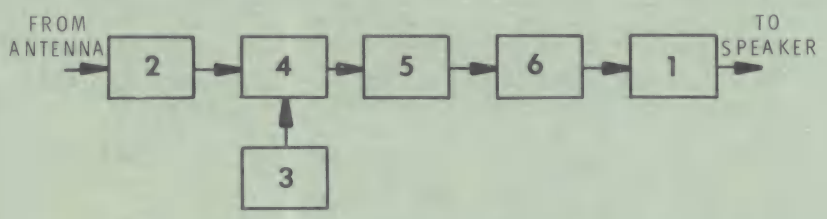
The purpose of a key-click filter is to _____ the spikes caused when you suddenly open or close a _____ _____.

remove telegraph key

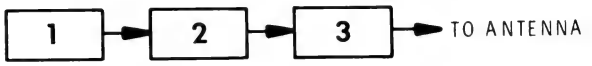
11. Write the numbers, beside the names given below, in the proper blocks of the receiver diagram.

1. AF Amplifier.
2. RF Amplifier.
3. Local Oscillator.
4. Mixer.
5. IF Amplifier
6. Detector.





12. What is the name of block #3 in the following transmitter block diagram?



A. Oscillator.
B. Frequency multiplier.
C. Detector.
D. AF amplifier.
E. Final amplifier.

E

13. **The purpose of a low-pass filter is to pass signals below a particular frequency but block any higher frequency signals.**

The particular frequency mentioned above, called the cutoff frequency, is determined by the filter's design.

Low-pass filters are used at the output of a transmitter to suppress interference with other higher frequency receivers. One specific use of the filter is to prevent interference to television receivers.

The purpose of a low-pass filter is to _____ signals below a particular frequency but _____ any higher frequency signals.

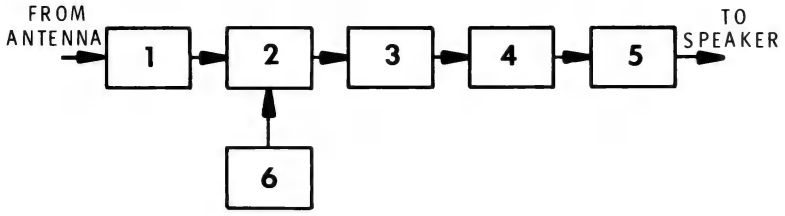
pass block

14. Which of the following best describes the purpose of a key-click filter?

A. A key-click filter is used on a receiver to remove spikes on received signals.
B. A key-click filter is used on a receiver to remove spikes on a transmitted signal.
C. A key-click filter is used on a transmitter to remove spikes on a received signal.
D. A key-click filter is used on a telegraph key to remove the spikes caused when you suddenly open or close the key.
E. A key-click filter is used on the antenna to remove spikes caused when you open and close a telegraph key.

D

15. What is the name of block #4 in the following receiver block diagram?



A. Local oscillator.
B. AF amplifier.
C. RF amplifier.
D. IF amplifier.
E. Detector.

E

16. **The purpose of a high-pass filter is to pass signals above a certain frequency but block signals below this frequency.**

High-pass filters are used at the antenna input terminals of a receiver to reduce interference from a nearby transmitter. A common use of this type of filter is at the antenna terminals on a television set.

The purpose of a high-pass filter is to _____ signals above a certain frequency but _____ signals below this frequency.

pass block

17. Which of the following statements is true concerning the purpose of a low-pass filter?

A. The purpose of a low-pass filter is to pass signals below a particular frequency but block any higher frequency signals.
B. The purpose of a low-pass filter is to block signals below a particular frequency but pass any higher frequency signals.
C. The purpose of a low-pass filter is to pass signals above a particular frequency but block any lower frequency signals.
D. All of the above are true.
E. None of the above are true.

A

18. Where should you connect a key-click filter?

A. Across the antenna terminals at your antenna.
B. Across the antenna terminals at your receiver.
C. Across the antenna terminals at your transmitter.
D. Across the contacts of your telegraph key.
E. Across your speaker terminals.

D

19. As you should recall from an earlier module, rectification is the process of changing AC into DC.

The circuit shown in Figure 7-6 is called a half-wave rectifier. This circuit gets its name from the fact that current flows for only half of the time.

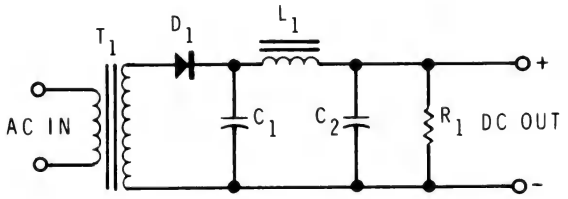
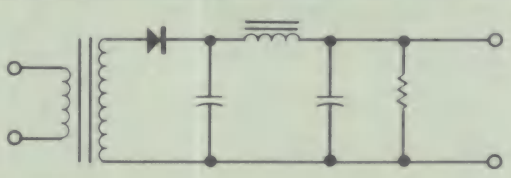


Figure 7-6

In this circuit, transformer T_1 steps the AC input voltage either up or down as required. Diode D_1 changes the AC into pulsating DC and capacitors C_1, C_2, and choke L_1 smooth out these pulsations. Resistor R_1, also called a bleeder resistor, discharges the capacitor when the AC input voltage is removed. This resistor also improves the voltage regulation (helps hold the output voltage constant).

NOTE: The type of filter shown in Figure 7-6 is called a capacitor-input filter, since the first component after the diode is a capacitor. If C_1 was removed from this circuit the filter would be called a choke-input filter.

Draw the schematic of a half-wave rectifier with a capacitor-input filter. It is not necessary to label the components.



20. Which of the following statements is true concerning the purpose of a high-pass filter?

A. The purpose of a high-pass filter is to pass signals below a certain frequency but block higher frequency signals.
B. The purpose of a high-pass filter is to block signals above a certain frequency but pass lower frequency signals.
C. The purpose of a high-pass filter is to pass signals above a certain frequency but block signals below this frequency.
D. All of the above are true.
E. None of the above are true.

C

21. What type of filter would pass signals below a certain frequency but block any higher frequency signals?

A. A key-click filter.
B. A low-pass filter.
C. A low block filter.
D. A high-pass filter.
E. A bandpass filter.

B

22. Another circuit commonly used to change AC into DC is called a full-wave rectifier.

Figure 7-7 shows the schematic of a full-wave rectifier circuit. This circuit gets its name from the fact that current flows all the time.

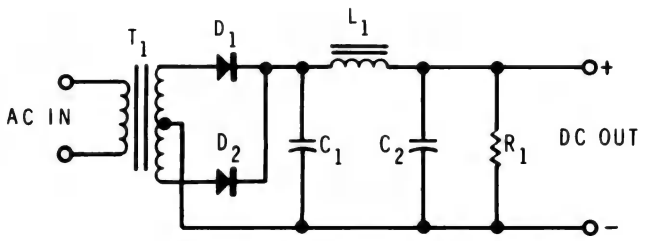
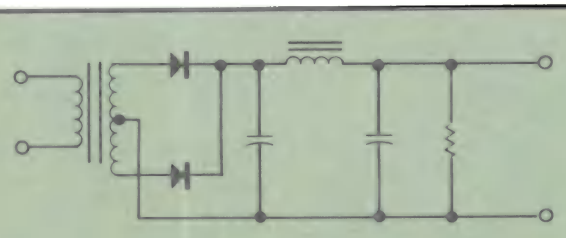


Figure 7-7

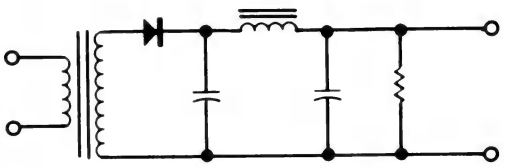
In this circuit, transformer T_1 (which must have a center-tapped winding) steps the AC input voltage up or down as required and diodes D_1 and D_2 change this voltage to pulsating DC. The rest of the circuit operates in the same manner as it does in the half-wave rectifier circuit.

Again, the type of filter shown in Figure 7-7 is a capacitor-input type, since the first component following the diodes is a capacitor.

Draw the schematic of a full-wave rectifier circuit with a capacitor-input filter. It is not necessary to label the components.



23. What kind of circuit is shown below?



A. A half-wave regulator circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A full-wave regulator circuit.
E. A half-wave rectifier circuit.

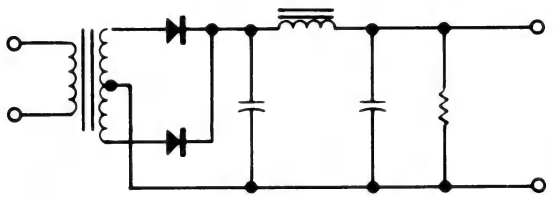
E

24. What type of filter would pass signals above a certain frequency but block any lower frequency signals?

A. A low-pass filter.
B. A high-pass filter.
C. A high block filter.
D. A key-click filter.
E. A bandpass filter.

B

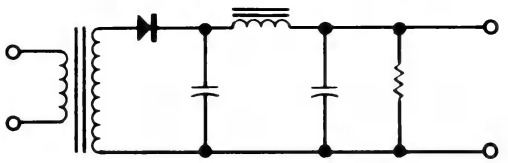
25. What kind of circuit is shown below?



A. A full-wave rectifier circuit.
B. A key-click filter.
C. A half-wave regulator circuit.
D. A full-wave regulator circuit.
E. A half-wave rectifier circuit.

A

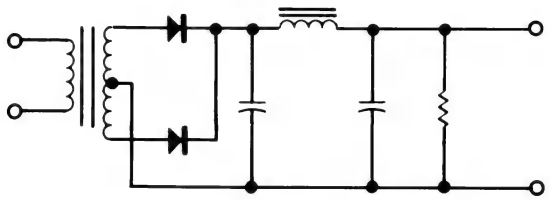
26. What kind of circuit is shown below?



A. A half-wave regulator circuit.
B. A bandpass filter.
C. A half-wave rectifier circuit.
D. A full-wave rectifier circuit.
E. A key-click filter.

C

27. What kind of circuit is shown below?



A. A half-wave rectifier circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A full-wave regulator circuit.
E. An oscillator circuit.

B

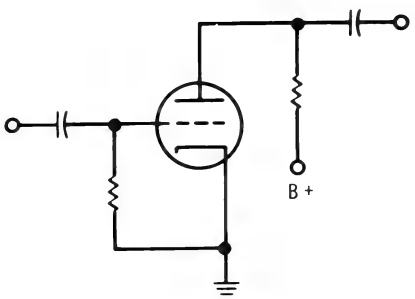
Proceed to the audio "Review of Practical Circuits" (Tape 1, Side B).

MODULE EXAMINATION

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Examination Answers," which follows.

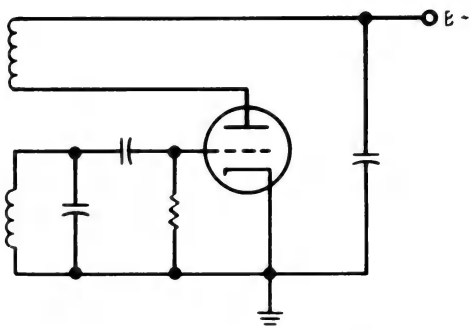
- If you miss more than two questions, re-read this whole module.
- If you have less than two incorrect answers, go back and study those frames pertaining to the questions you missed (the number in the parentheses, following the correct answer, refers you to the proper frame). Then proceed to the next module.

1. What kind of circuit is shown below?



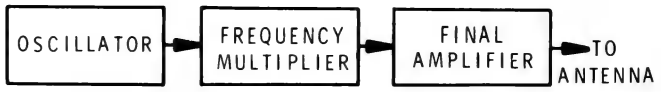
A. A low-pass filter.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A full-wave rectifier circuit.
E. A half-wave rectifier.

2. What kind of circuit is shown below?



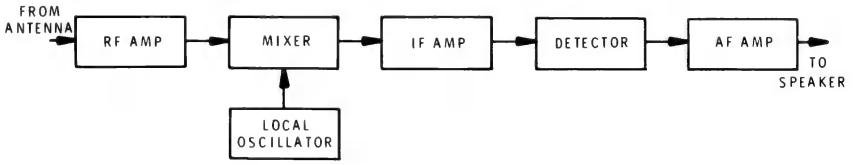
A. A basic oscilloscope circuit.
B. A basic amplifier circuit.
C. A basic oscillator circuit.
D. A basic amplitude circuit.
E. None of the above.

3. What does the following block diagram represent?



A. A simple transmitter.
B. A simple receiver.
C. A key-click filter.
D. A basic amplifier.
E. A low-pass filter.

4. What does the following block diagram represent?



A. A simple amplifier.
B. A simple receiver.
C. A simple transmitter.
D. A high-pass filter.
E. A simple oscillator.

5. Which of the following best describes the purpose of a key-click filter?

   A. A key-click filter is used on a receiver to remove spikes on received signals.
   B. A key-click filter is used on a receiver to remove spikes on a transmitted signal.
   C. A key-click filter is used on a transmitter to remove spikes on a received signal.
   D. A key-click filter is used on a telegraph key to remove spikes caused when you suddenly open or close a telegraph key.
   E. A key-click filter is used on the antenna to remove spikes caused when you open and close a telegraph key.

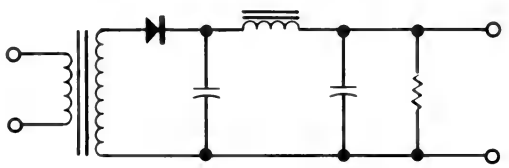
6. Which of the following statements is true concerning the purpose of a low-pass filter?

   A. The purpose of a low-pass filter is to pass signals below a certain frequency but block any higher frequency signals.
   B. The purpose of a low-pass filter is to block signals below a certain frequency but pass any higher frequency signals.
   C. The purpose of a low-pass filter is to pass signals above a certain frequency but block any lower frequency signals.
   D. All of the above are true.
   E. None of the above are true.

7. Which of the following statements is true concerning the purpose of a high-pass filter?

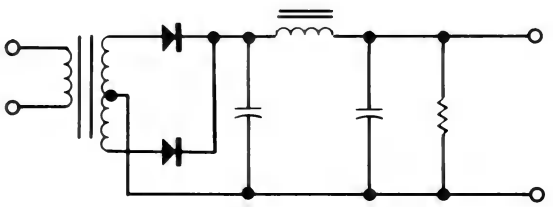
   A. The purpose of a high-pass filter is to pass signals below a certain frequency but block higher frequency signals.
   B. The purpose of a high-pass filter is to block signals above a certain frequency but pass lower frequency signals.
   C. The purpose of a high-pass filter is to pass signals above a certain frequency but block signals below this frequency.
   D. All of the above are true.
   E. None of the above are true.

8. What kind of circuit is shown below?



A. A half-wave receiver circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A basic receiver circuit.
E. A half-wave rectifier circuit.

9. What kind of circuit is shown below?



A. A half-wave rectifier circuit.
B. A full-wave rectifier circuit.
C. A key-click filter.
D. A full-wave receiver circuit.
E. An oscillator circuit.

EXAMINATION ANSWERS

Q	A	FRAME NO.
1.	B	(1)
2.	C	(2)
3.	A	(4)
4.	B	(7)
5.	D	(10)
6.	A	(13)
7.	C	(16)
8.	E	(19)
9.	B	(22)

HEATHKIT CONTINUING EDUCATION

Individual Learning Program

In

AMATEUR RADIO

(NOVICE LICENSE)

8 ANTENNAS AND TRANSMISSION LINES

703-11

HEATHKIT
CONTINUING
EDUCATION

Individual Learning Program

AMATEUR RADIO

(NOVICE LICENSE)

Module 8

ANTENNAS AND TRANSMISSION LINES

ER-3701

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

MODULE OBJECTIVES

When you complete this module, you will be able to select or determine:

1. The meaning of "electrical length."
2. The meaning of "antenna input impedance."
3. The meaning of "characteristic impedance."
4. The meaning of "dipole antenna."
5. The meaning of "standing waves."
6. The meaning of "transmatch."
7. The formula for determining the length in feet of a half-wave antenna.
8. The approximate length of a half-wave antenna suitable for use on the 80-meter novice band.
9. The approximate length of a half-wave antenna suitable for use on the 40-meter novice band.
10. The approximate length of a half-wave antenna suitable for use on the 15-meter novice band.
11. The approximate length of a half-wave antenna suitable for use on the 10-meter novice band.
12. The meaning of "harmonic operation."
13. The three main types of transmission line.
14. The meaning of "standing wave ratio."
15. The most used method of determining SWR.

MODULE PRETEST

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Pretest Answers," which follows.

- If you miss more than three questions, read this whole module.
- If you have less than three incorrect answers, you may either study those frames pertaining to the questions you missed (the number in parentheses, following the correct answer, refers you to the proper frame) or, you can skip this module and proceed to the next module.

1. The **electrical** length of an antenna refers to which of the following?

   A. Its physical length.
   B. Its length in feet.
   C. Its length in yards.
   D. Its length in wavelengths.
   E. Its length in inches.

2. Select the true statement concerning antenna input impedance.

   A. Antenna input impedance is the same at all points along an antenna.
   B. Antenna input impedance is the same as characteristic impedance.
   C. Antenna input impedance depends on the impedance of the feedline.
   D. Antenna input impedance is the impedance of an antenna at the point where the feedline is attached.
   E. None of the above.

3. What does characteristic impedance refer to?

   A. The average impedance of a dipole antenna.
   B. The impedance at the center of an antenna.
   C. The average impedance of any antenna.
   D. The impedance of an antenna and its feedline.
   E. The impedance of a transmission line.

4. Which of the following best describes a dipole antenna?

   A. A dipole antenna is an antenna which has the signal applied at one end and is usually one-half wave long.
   B. A dipole antenna is an antenna which has the signal applied at both ends and is usually one-half wave long.
   C. A dipole antenna is an antenna which has the signal applied at its center and is usually one-half wave long.
   D. A dipole antenna is an antenna which has the signal applied at its center and is usually one full wave long.
   E. A dipole antenna is an antenna which usually has the signal applied at its center and is two waves long.

5. Select the best definition of a standing wave.

   A. A standing wave is a motionless wave on an antenna that is caused by a perfect match.
   B. A standing wave is a motionless wave on an antenna that is caused by a mismatch.
   C. A standing wave is a moving wave on an antenna that is caused by a perfect match.
   D. A standing wave is a motionless wave on an antenna that causes a perfect match.
   E. A standing wave is a motionless wave on an antenna that causes a mismatch.

6. Select the best description of a transmatch.

   A. A transmatch is an adjustable matching device.
   B. A transmatch matches the output impedance of a transmitter to that of a transmission line.
   C. A transmatch improves the efficiency of an antenna system.
   D. A transmatch attenuates harmonics.
   E. All of the above.

7. Select the correct equation for determining the length of a half-wave antenna.

   A. $L_{(ft)} = \frac{468}{F\ (kHz)}$

B. $L_{(in)} = \frac{468}{F\ (MHz)}$

C. $L_{(ft)} = \frac{468}{F\ (Hz)}$

D. $L_{(ft)} = \frac{468}{F\ (MHz)}$

E. $F = \frac{468}{L}$

8. Select the approximate length of a half-wave antenna suitable for use on the 80-meter novice band.

A. 126 feet.
B. 66 feet.
C. 80 feet.
D. 40 feet.
E. 63 feet.

9. Select the approximate length of a half-wave antenna suitable for use on the 40-meter novice band.

A. 126 feet.
B. 40 feet.
C. 66 feet.
D. 20 feet.
E. 33 feet.

10. Select the approximate length of a half-wave antenna suitable for use on the 15-meter novice band.

A. 15 feet.
B. 126 feet.
C. 22 feet.
D. 66 feet.
E. 11 feet.

11. Select the approximate length of a half-wave antenna suitable for use on the 10-meter novice band.

A. 126 feet.
B. 66 feet.
C. 5 feet.
D. 11 feet.
E. 17 feet.

12. Which of the following statements best describes harmonic operation?

A. Harmonic operation is the practice of using a dipole antenna at an even multiple of its normal operating frequency.
B. Harmonic operation is the practice of using a dipole antenna at an odd multiple of its normal operating frequency.
C. Harmonic operation is the practice of using a dipole antenna at a frequency that is less than its normal operating frequency.
D. Harmonic operation is the practice of using a dipole antenna at any frequency other than its normal operating frequency.
E. Harmonic operation is the practice of using a dipole antenna at any frequency that is higher than its normal operating frequency.

13. Which of the following is **not** a commonly used type of transmission line?

A. Zip cord.
B. Coaxial cable.
C. Ribbon wire.
D. Single wire.
E. Open-wire parallel line.

14. Which of the following best describes standing wave ratio?

A. Standing wave ratio is a comparison of maximum voltage to minimum current along a line.
B. Standing wave ratio is a comparison of maximum current to minimum voltage along a line.
C. Standing wave ratio is the difference between the maximum voltage (or current) and the minimum voltage (or current) along a line.
D. Standing wave ratio is a comparison of maximum voltage (or current) to the minimum voltage (or current) along a line.
E. None of the above.

15. Which of the following is the most common method of measuring SWR?

A. With a voltmeter.
B. With an SWR bridge.
C. With an ammeter.
D. With a VTVM.
E. With an ohmmeter.

PRETEST ANSWERS

Q	A	FRAME NO.
1.	D	(1)
2.	D	(2)
3.	E	(4)
4.	C	(7)
5.	B	(10)
6.	E	(13)
7.	D	(16)
8.	A	(19)
9.	C	(22)
10.	C	(25)
11.	E	(28)
12.	B	(31)
13.	A	(34)
14.	D	(37)
15.	B	(40)

INTRODUCTION

Many amateur radio operators consider the antenna system to be the most important part of their stations.

This module deals with antennas and the proper methods of coupling the signal from the transmitter to the antenna. You will learn the importance of matching the transmitter to the feedline and the feedline to the antenna. You will also learn how to determine the length of an antenna for a specific frequency and the approximate lengths for each novice band.

PROGRAMMED INSTRUCTION

1. You should recall from Module 2 that wavelength is the length of one cycle of a radio wave.

   Antennas are usually made to operate at a specific number of wavelengths (half, quarter, etc.) at the operating frequency. This practice results in the best antenna efficiency.

   The electrical length of an antenna refers to its length in wavelengths.

   The electrical length of an antenna is always greater than its physical length, since a radio wave has less velocity at a given antenna installation than it does in free space.

   The electrical length of an antenna refers to its _____ in _____.

   length wavelengths

2. Circuits that contain capacitance or inductance and operate at some frequency have what is called impedance instead of resistance. Impedance, like resistance, also uses ohms as its unit of measure. Impedance cannot, however, be measured with an ordinary ohmmeter.

   The impedance of an antenna at the point where the lead-in (called a feedline or transmission line) is attached is called the antenna input impedance.

   Note that the impedance is not the same at all points along a given antenna.

   The impedance of an antenna at the point where the feedline is attached is called the _____ _____ _____.

   antenna input impedance

3. The electrical length of an antenna refers to which of the following?

A. Its physical length.
B. Its length in wavelengths.
C. Its length in feet.
D. Its length in yards.
E. Its length in inches.

B

4. **The impedance of a transmission line, or feedline, is expressed as its "characteristic impedance."**

The characteristic impedance of a line depends on the size (diameter) of the line's conductors, or wires, and the space between the conductors.

The impedance of a transmission line is expressed as its _____ _____.

characteristic impedance

5. Which of the following statements concerning antenna input impedance is true?

A. The antenna input impedance is the impedance of an antenna at the point where the feedline is attached.
B. Antenna input impedance is the same at all points along an antenna.
C. Antenna input impedance is the same as characteristic impedance.
D. Antenna input impedance depends on the impedance of the feedline.
E. All of the above.

A

6. The electrical length of an antenna refers to which of the following?

A. Its physical length.
B. Its length in feet.
C. Its length in yards.
D. Its length in wavelengths.
E. Its length in inches.

D

7. One of the most used antenna types for beginners is the "dipole antenna."

A dipole antenna is an antenna which usually has the signal applied at its center. Dipole antennas are usually one-half wave in length.

Figure 8-1 shows a typical half-wave dipole antenna. Note that each side of the antenna is 1/4 wavelength, which results in a total length of 1/2 wavelength.

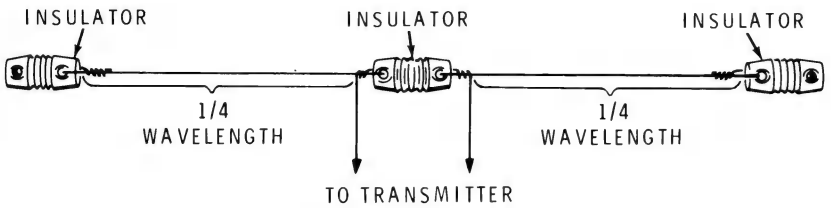


Figure 8-1

A dipole antenna is an antenna which usually has the signal applied at its _____. Dipole antennas are usually one-_____ wave in length.

center half

8. Which of the following best describes characteristic impedance.

A. The impedance at the center of an antenna.
B. The impedance of a transmission line.
C. The average impedance of any antenna.
D. The average impedance of a dipole antenna.
E. The impedance of an antenna and its feedline.

B

9. Select the true statement concerning antenna input impedance.

A. Antenna input impedance is the same at all points along the antenna.
B. Antenna input impedance is the same as characteristic impedance.
C. Antenna input impedance depends on the impedance of the feedline.
D. Antenna input impedance is the impedance of an antenna at the point where the feedline is attached.
E. None of the above.

D

10. For maximum efficiency, an antenna must be the proper length for the frequency at which it operates. Just as important, the characteristic impedance of the transmission line and the antenna input impedance must match. If a mismatch occurs anywhere in the antenna system, standing waves will result.

A standing wave is a motionless wave on an antenna that is caused by a mismatch.

When an impedance mismatch occurs in an antenna system, voltage and current is reflected back down the transmission line toward the transmitter. This causes a power loss and results in poor antenna efficiency.

A standing wave is a _____ wave on an antenna that is caused by a _____.

motionless mismatch

11. Which of the following statements is true?

A. A dipole antenna is an antenna which has the signal applied at either end and is usually one-half wave long.
B. A dipole antenna is an antenna which has the signal applied at either end and is usually one full wave long.
C. A dipole antenna is an antenna which has the signal applied at its center and is usually one-half wave long.
D. A dipole antenna is an antenna which has the signal applied at its center and is usually one full wavelength.
E. A dipole antenna is an antenna which usually has the signal applied at its center and is usually one-quarter wave long.

C

12. What does characteristic impedance refer to?

A. The average impedance of a dipole antenna.
B. The impedance at the center of an antenna.
C. The average impedance of any antenna.
D. The impedance of an antenna and its feedline.
E. The impedance of a transmission line.

E

13. Just as important as the impedance of the feedline matching the antenna, the output impedance of the transmitter must also match the impedance of the feedline.

An adjustable device that is able to match the output impedance of a transmitter to that of a feedline and, at the same time, attenuate harmonics (reduce unwanted frequencies) is called a transmatch.

A transmatch improves the efficiency of an antenna system and reduces the possibility of interference to other communications.

An adjustable device that is able to match the output _____ of a transmitter to that of a feedline and, at the same time, _____ harmonics is called a transmatch.

impedance attenuate

14. Which of the following best describes a standing wave?

A. A standing wave is a motionless wave on an antenna that is caused by a mismatch.
B. A standing wave is a moving wave on an antenna that is caused by a mismatch.
C. A standing wave is a motionless wave on an antenna that is caused by a perfect match.
D. A standing wave is a motionless wave on an antenna that causes a mismatch.
E. A standing wave is a motionless wave on an antenna that causes a perfect match.

A

15. Which of the following best describes a dipole antenna?

A. A dipole antenna is an antenna which has the signal applied at one end and is usually one-half wave long.
B. A dipole antenna is an antenna which has the signal applied at both ends and is usually one-half wave long.
C. A dipole antenna is an antenna which has the signal applied at its center and is usually one-half wave long.
D. A dipole antenna is an antenna which has the signal applied at its center and is usually one full wave long.
E. A dipole antenna is an antenna which usually has the signal applied at its center and is two waves long.

C

16. As you learned earlier, an antenna must be the proper length for the frequency at which it operates if you want maximum efficiency.

The equation for determining the length of a half-wave antenna is:

$$L_{(ft)} = \frac{468}{F\ (MHz)}$$

Notice that the length (L) is in feet and the frequency (F) is in megahertz. If you are given the wavelength, such as "the 40 meter band," you must first change the wavelength in meters to the frequency in megahertz. The method of changing wavelength to frequency in megahertz was explained in Module 2.

What is the equation for determining the length of a half-wave antenna?

$$L_{(ft)} = \frac{468}{F\ (MHz)}$$

17. Which of the following statements is true concerning a transmatch?

A. A transmatch is an adjustable matching device.
B. A transmatch matches the output impedance of a transmitter to that of a transmission line.
C. A transmatch improves the efficiency of an antenna system.
D. A transmatch attenuates harmonics.
E. All of the above.

E

18. Select the best description of a standing wave.

A. A standing wave is a motionless wave on an antenna that is caused by a perfect match.
B. A standing wave is a motionless wave on an antenna that is caused by a mismatch.
C. A standing wave is a moving wave on an antenna that is caused by a mismatch.
D. A standing wave is a motionless wave on an antenna that causes a perfect match.
E. A standing wave is a motionless wave on an antenna that causes a mismatch.

B

19. **The approximate length of a half-wave antenna suitable for use on the 80-meter novice band (3.7 — 3.75 MHz) is 126 feet.**

You can determine this by using the equation in frame 16:

$$L_{(ft)} = \frac{468}{3.725 \text{ MHz}}$$

L = 125.6 (round off to 126) feet.

Antennas are usually cut for the center of the band of operation. In this case, 3.725 MHz is the center of the 80-meter novice band.

What is the approximate length of a half-wave antenna suitable for use on the 80-meter novice band? _____.

126 feet

20. Which of the following is the correct equation for determining the length of a half-wave antenna?

A. $L_{(ft)} = \frac{468}{F\ (kHz)}$

B. $L_{(ft)} = \frac{300}{F\ (MHz)}$

C. $L_{(ft)} = \frac{468}{F\ (Hz)}$

D. $L_{(ft)} = \frac{468}{F\ (MHz)}$

E. $F = \frac{468}{L}$

D

21. Select the true statement concerning a transmatch.

A. A transmatch is an adjustable matching device.
B. A transmatch matches the output impedance of a transmitter to that of a transmission line.
C. A transmatch improves the efficiency of an antenna system.
D. A transmatch attenuates harmonics.
E. All of the above.

E

22. **The approximate length of a half wave antenna suitable for use on the 40-meter novice band (7.1 — 7.15 MHz) is 66 feet.**

$$L_{(ft)} = \frac{468}{7.125\ MHz}$$

$$L = 65.6 \text{ (or 66) feet.}$$

What is the approximate length of a half-wave antenna suitable for use on the 40-meter novice band? _____.

66 feet

23. Which of the following is the approximate length of a half-wave antenna suitable for use on the 80-meter novice band?

A. 126 feet.
B. 66 feet.
C. 80 feet.
D. 40 feet.
E. 63 feet.

A

24. Select the correct equation for determining the length of a half-wave antenna.

A. $L_{(ft)} = \frac{468}{F\ (kHz)}$

B. $L_{(in)} = \frac{300}{F\ (MHz)}$

C. $L_{(ft)} = \frac{468}{F\ (Hz)}$

D. $L_{(ft)} = \frac{468}{F\ (MHz)}$

E. $F = \frac{468}{L}$

D

25. **The approximate length of a half wave antenna suitable for use on the 15-meter novice band (21.1 — 21.2 MHz) is 22 feet.**

$$L_{(ft)} = \frac{468}{21.15}$$

L = 22.1 (or 22) feet

What is the approximate length of a half-wave antenna suitable for use on the 15-meter novice band? _____.

22 feet

26. Which of the following is the approximate length of a half-wave antenna suitable for use on the 40-meter novice band?

A. 126 feet.
B. 40 feet.
C. 66 feet.
D. 20 feet.
E. 33 feet.

C

27. Which novice band would a half-wave antenna that is 126 feet long be used on?

A. 40 meters.
B. The 3.7 — 3.75 MHz band.
C. 15 meters.
D. 10 meters.
E. The 7.1 — 7.15 MHz band.

B

28. **The approximate length of a half-wave antenna suitable for use on the 10-meter novice band (28.1 — 28.2 MHz) is 17 feet.**

$$L_{(ft)} = \frac{468}{28.15\ MHz}$$

$$L = 16.6 \text{ (or 17) feet}$$

What is the approximate length of a half-wave antenna suitable for use on the 10-meter novice band? _____.

17 feet

29. Which of the following is the approximate length of a half-wave antenna suitable for use on the 15-meter novice band?

A. 15 feet.
B. 126 feet.
C. 22 feet.
D. 66 feet.
E. 11 feet.

C

30. Which novice band would a half-wave antenna that is 66 feet long be used on?

A. The 7.1 — 7.15 MHz band.
B. 80 meters.
C. 15 meters.
D. 10 meters.
E. The 21.1 — 21.2 MHz band.

A

31. As you learned earlier, a dipole antenna works best at the frequency it was made for. A dipole antenna will also work satisfactorily at an odd multiple of its "cut for" frequency.

When you use a dipole at an odd multiple of its normal operating frequency, you are using what is called "harmonic operation."

Harmonic operation can be used to your advantage on the 40- and 15-meter bands. Since the frequency of the 15-meter band is three times the frequency of the 40-meter band, a 40-meter dipole will work well on 15 meters.

For maximum efficiency on both bands, the 40-meter dipole should be cut for the low end (around 7.1 MHz) of the band.

When you use a dipole at an odd multiple of its normal operating frequency, you are using what is called _____ _____.

harmonic operation

32. Which of the following is the approximate length of a half-wave antenna suitable for use on the 10-meter novice band?

A. 126 feet.
B. 66 feet.
C. 5 feet.
D. 11 feet.
E. 17 feet.

E

33. Which novice band would a half-wave antenna that is 22 feet long be used on?

A. 20 meters.
B. 40 meters.
C. The 28.1 — 28.2 MHz band.
D. The 21.1 — 21.2 MHz band.
E. 10 meters.

D

34. There are several types of transmission lines that are used to connect the transmitter to the antenna.

The three main types of transmission line are the single wire, the open-wire parallel line, and the coaxial cable. These cables are shown in Figure 8-2 along with the ribbon wire type (also called twin lead) which is similar to the open-wire parallel line.

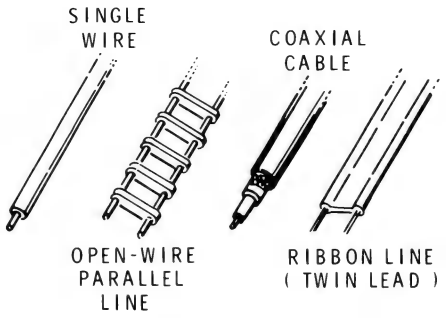


Figure 8-2

Probably the most-used type of transmission line in an amateur installation is the coaxial cable type.

List the names of the three main types of transmission line.

single wire, open-wire parallel line, coaxial cable.

35. Which of the following statements concerning harmonic operation is true?

A. Using a dipole at an even multiple of its normal operating frequency is called harmonic operation.
B. Using a dipole at less than its normal operating frequency is called harmonic operation.
C. Using a dipole at an odd multiple of its normal operating frequency is called harmonic operation.
D. Using a dipole at any frequency that is higher than its normal operating frequency is called harmonic operation.
E. None of the above.

C

36. Which novice band would a half-wave antenna that is 17 feet long be used on?

A. 80 meters.
B. 40 meters.
C. 20 meters.
D. 15 meters.
E. 10 meters.

E

37. As you learned earlier, standing waves are motionless waves of voltage or current on an antenna that are caused by an impedance mismatch.

The ratio of maximum voltage (or current) to minimum voltage (or current) along a line is called "standing wave ratio (SWR)."

For best results, the standing wave ratio should be as low as possible (1 to 1).

The ratio of maximum voltage (or current) to minimum voltage (or current) along a line is called _____ _____ _____.

standing wave ratio

38. Which of the following is a commonly used type of transmission line?

A. Ribbon wire.
B. Coaxial cable.
C. Single wire.
D. Open-wire parallel line.
E. All of the above.

E

39. Which of the following statements best describes harmonic operation?

A. Harmonic operation is the practice of using a dipole antenna at an even multiple of its normal operating frequency.
B. Harmonic operation is the practice of using a dipole antenna at an odd multiple of its normal operating frequency.
C. Harmonic operation is the practice of using a dipole antenna at a frequency that is less than its normal operating frequency.
D. Harmonic operation is the practice of using a dipole antenna at any frequency other than its normal operating frequency.
E. Harmonic operation is the practice of using a dipole antenna at any frequency that is higher than its normal operating frequency.

B

40. There are several ways that you can determine the SWR on a line. One method is to measure the amounts of maximum and minimum voltage or current along the line and then use them in the following equation:

$$SWR = \frac{MAX.}{MIN.} \text{ (either voltage or current)}$$

The most common method (and the easiest) is to use an SWR bridge (or reflectometer) which measures the forward and reflected values of voltage and indicates the SWR on a meter.

An SWR bridge is simply connected between the transmitter and antenna as shown in Figure 8-3.

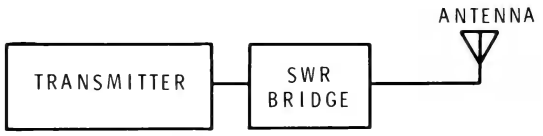


Figure 8-3

The most common method of determining the SWR on a line is to use an _____ _____ which measures the forward and reflected values of voltage and indicates the SWR on a meter.

SWR bridge

41. Which of the following statements concerning standing wave ratio is true?

A. The sum of the maximum voltage (or current) and the minimum voltage (or current) along a line is called standing wave ratio.
B. The ratio of maximum voltage (or current) to the minimum voltage (or current) along a line is called standing wave ratio.
C. The difference between the maximum voltage (or current) and the minimum voltage (or current) along a line is called standing wave ratio.
D. The ratio of maximum voltage to minimum current along a line is called standing wave ratio.
E. The ratio of maximum current to minimum voltage along a line is called standing wave ratio.

B

42. Which of the following is **not** a commonly used type of transmission line?

A. Zip cord.
B. Coaxial cable.
C. Ribbon wire.
D. Single wire.
E. Open-wire parallel line.

A

43. Which of the following instruments is most commonly used to measure SWR?

A. A voltmeter.
B. An ammeter.
C. An SWR bridge.
D. An ohmmeter.
E. A VTVM.

C

44. Which of the following best describes standing wave ratio?

A. Standing wave ratio is a ratio of maximum voltage to minimum current along a line.
B. Standing wave ratio is a ratio of maximum current to minimum voltage along a line.
C. Standing wave ratio is the difference between the maximum voltage (or current) and the minumum voltage (or current) along a line.
D. Standing wave ratio is a ratio of maximum voltage (or current) to the minimum voltage (or current) along a line.
E. None of the above.

D

45. Which of the following is the most common method of measuring SWR?

A. With a voltmeter.
B. With an SWR bridge.
C. With an ammeter.
D. With a VTVM.
E. With an ohmmeter.

B

MODULE EXAMINATION

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Examination Answers," which follows.

- If you miss more than three questions, go back and re-read this whole module.
- If you have less than three incorrect answers, go back and study those frames pertaining to the questions you missed (the number in parentheses, following the correct answer, refers you to the proper frame). Then proceed to the next module.

1. The **electrical** length of an antenna refers to which of the following?

   A. Its physical length.
   B. Its length in feet.
   C. Its length in yards.
   D. Its length in wavelengths.
   E. Its length in inches.

2. Select the true statement concerning antenna input impedance.

   A. Antenna input impedance is the same at all points along an antenna.
   B. Antenna input impedance is the same as characteristic impedance.
   C. Antenna input impedance depends on the impedance of the feedline.
   D. Antenna input impedance is the impedance of an antenna at the point where the feedline is attached.
   E. None of the above.

3. What does characteristic impedance refer to?

   A. The average impedance of a dipole antenna.
   B. The impedance at the center of an antenna.
   C. The average impedance of any antenna.
   D. The impedance of an antenna and its feedline.
   E. The impedance of a transmission line.

4. Which of the following best describes a dipole antenna?

A. A dipole antenna is an antenna which has the signal applied at one end and is usually one-half wave long.
B. A dipole antenna is an antenna which has the signal applied at both ends and is usually one-half wave long.
C. A dipole antenna is an antenna which has the signal applied at its center and is usually one-half wave long.
D. A dipole antenna is an antenna which has the signal applied at its center and is usually one full wave long.
E. A dipole antenna is an antenna which usually has the signal applied at its center and is two waves long.

5. Select the best definition of a standing wave.

A. A standing wave is a motionless wave on an antenna that is caused by a perfect match.
B. A standing wave is a motionless wave on an antenna that is caused by a mismatch.
C. A standing wave is a moving wave on an antenna that is caused by a perfect match.
D. A standing wave is a motionless wave on an antenna that causes a perfect match.
E. A standing wave is a motionless wave on an antenna that causes a mismatch.

6. Select the best description of a transmatch.

A. A transmatch is an adjustable matching device.
B. A transmatch matches the output impedance of a transmitter to that of a transmission line.
C. A transmatch improves the efficiency of an antenna system.
D. A transmatch attenuates harmonics.
E. All of the above.

7. Select the correct equation for determining the length of a half-wave antenna.

A. $L_{(ft)} = \frac{468}{F\ (kHz)}$

B. $L_{(in)} = \frac{468}{F\ (MHz)}$

C. $L_{(ft)} = \frac{468}{F\ (Hz)}$

D. $L_{(ft)} = \frac{468}{F\ (MHz)}$

E. $F = \frac{468}{L}$

8. Select the approximate length of a half-wave antenna suitable for use on the 80-meter novice band.

A. 126 feet.
B. 66 feet.
C. 80 feet.
D. 40 feet.
E. 63 feet.

9. Select the approximate length of a half-wave antenna suitable for use on the 40-meter novice band.

A. 126 feet.
B. 40 feet.
C. 66 feet.
D. 20 feet.
E. 33 feet.

10. Select the approximate length of a half-wave antenna suitable for use on the 15-meter novice band.

A. 15 feet.
B. 126 feet.
C. 22 feet.
D. 66 feet.
E. 11 feet.

11. Select the approximate length of a half-wave antenna suitable for use on the 10-meter novice band.

A. 126 feet.
B. 66 feet.
C. 5 feet.
D. 11 feet.
E. 17 feet.

12. Which of the following statements best describes harmonic operation?

A. Harmonic operation is the practice of using a dipole antenna at an even multiple of its normal operating frequency.
B. Harmonic operation is the practice of using a dipole antenna at an odd multiple of its normal operating frequency.
C. Harmonic operation is the practice of using a dipole antenna at a frequency that is less than its normal operating frequency.
D. Harmonic operation is the practice of using a dipole antenna at any frequency other than its normal operating frequency.
E. Harmonic operation is the practice of using a dipole antenna at any frequency that is higher than its normal operating frequency.

13. Which of the following is **not** a commonly used type of transmission line?

A. Zip cord.
B. Coaxial cable.
C. Ribbon wire.
D. Single wire.
E. Open-wire parallel line.

14. Which of the following best describes standing wave ratio?

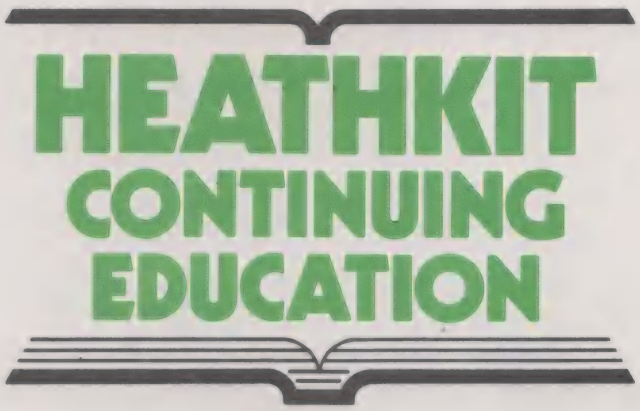
A. Standing wave ratio is a comparison of maximum voltage to minimum current along a line.
B. Standing wave ratio is a comparison of maximum current to minimum voltage along a line.
C. Standing wave ratio is the difference between the maximum voltage (or current) and the minimum voltage (or current) along a line.
D. Standing wave ratio is a comparison of maximum voltage (or current) to the minimum voltage (or current) along a line.
E. None of the above.

15. Which of the following is the most common method of measuring SWR?

A. With a voltmeter.
B. With an SWR bridge.
C. With an ammeter.
D. With a VTVM.
E. With an ohmmeter.

EXAMINATION ANSWERS

Q	A	FRAME NO.
1.	D	(1)
2.	D	(2)
3.	E	(4)
4.	C	(7)
5.	B	(10)
6.	E	(13)
7.	D	(16)
8.	A	(19)
9.	C	(22)
10.	C	(25)
11.	E	(28)
12.	B	(31)
13.	A	(34)
14.	D	(37)
15.	B	(40)



Individual Learning Program

In

AMATEUR RADIO

(NOVICE LICENSE)

HEATHKIT
CONTINUING
EDUCATION

Individual Learning Program

AMATEUR RADIO

(NOVICE LICENSE)

Module 9

RADIO COMMUNICATION PRACTICES

ER-3701

HEATH COMPANY
BENTON HARBOR, MICHIGAN 49022

MODULE OBJECTIVES

When you complete this module, you will be able to select:

1. The definition of a ground rod.
2. The meaning of "ground potential."
3. The meaning of "plate circuit."
4. The methods of preventing interference with other devices.
5. The meaning of "harmonic radiation."
6. The correct way to connect a voltmeter.
7. The correct way to connect an ammeter.
8. The correct way to connect and use an ohmmeter.
9. The correct way to connect and use a wattmeter.
10. The correct way to determine transmitter input power.
11. The proper sequence of tuning up a transmitter.
12. A method of checking for unwanted harmonics.
13. Four ways to reduce unwanted harmonics.
14. Four methods of preventing electrical shock.
15. The best method of protecting equipment from lightning.

MODULE PRETEST

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Pretest Answers" which follow.

- If you miss more than three questions, read this whole module.
- If you have less than three incorrect answers, you may either study those frames pertaining to the questions you missed (the number in parentheses, following the correct answer, refers you to the proper frame) or, you can skip this module and proceed to the practice examinations.

1. Which of the following best describes a ground rod?

   A. A ground rod is a metal pipe which is driven into the ground to make electrical connection to the earth.
   B. A ground rod is a metal pipe which is attached to a roof for lightning protection.
   C. A ground rod is a non-metallic pipe which is driven into the ground to make an electrical connection to the earth.
   D. A ground rod is a non-metallic pipe which is attached to a roof for lightning protection.
   E. None of the above.

2. Which of the following describes a ground potential?

   A. A ground potential is a term given a metallic object which has zero voltage with respect to the earth.
   B. A ground potential is a term given a non-metallic object which has zero voltage with respect to the earth.
   C. A ground potential is a term given a metallic object which has a negative potential.
   D. A ground potential is a term given a metallic object which has a positive potential.
   E. None of the above.

3. Which of the following best describes a "plate circuit?"

   A. A plate circuit is the internal circuit that is connected between the plate and the cathode of a tube.
   B. A plate circuit is the external circuit that is connected between the plate and the grid of a tube.
   C. A plate circuit is the external circuit that is connected between the plate and the cathode of a tube.
   D. A plate circuit is the internal circuit that is connected between the plate and the grid of a tube.
   E. A plate circuit is the external circuit that is connected between the grid and the cathode of a tube.

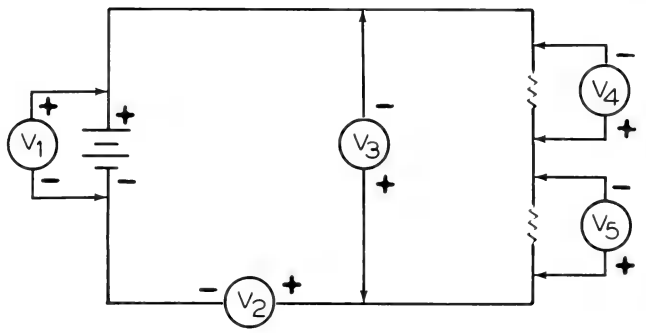
4. Which of the following would help prevent interference caused by your transmitter?

   A. Install a low-pass filter at the transmitter.
   B. Install a high-pass filter at the receiver being interfered with.
   C. Check your transmitter for proper adjustment.
   D. Use equipment of good design.
   E. All of the above.

5. Which of the following best describes harmonic radiation?

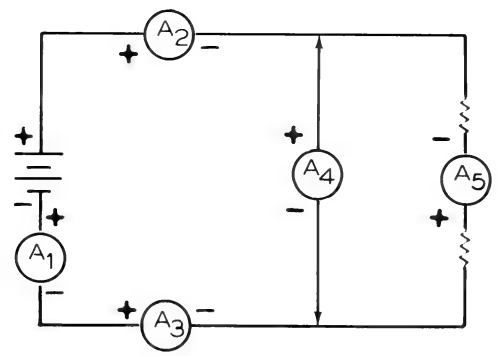
   A. Harmonic radiation is the reception of undesired frequencies.
   B. Harmonic radiation is the transmission of undesired multiples of a frequency.
   C. Harmonic radiation is the reception of desired frequencies.
   D. Harmonic radiation is the transmission of undesired fractions of a frequency.
   E. None of the above.

6. Which voltmeter in the following circuit is connected properly?



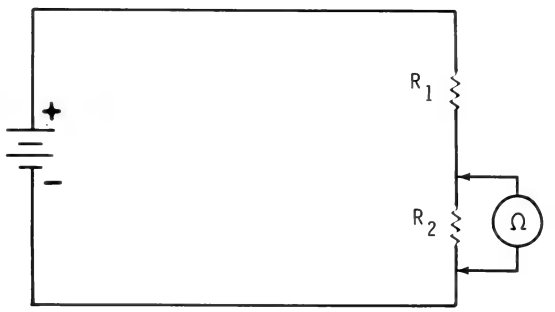
A. V_1.
B. V_2.
C. V_3.
D. V_4.
E. V_5.

7. Which ammeter in the following circuit is connected properly?



A. A_1.
B. A_2.
C. A_3.
D. A_4.
E. A_5.

8. What is wrong in the following circuit where the resistance of R_2 is being measured?



A. The battery polarity is wrong.
B. The meter should be connected in parallel with resistor R_1.
C. The meter should be connected in series with resistor R_2.
D. The battery should be disconnected from the circuit.
E. Nothing is wrong with the circuit.

9. Which of the following statements concerning wattmeters is true?

A. Wattmeters are normally connected in series between the transmitter and the antenna.
B. Wattmeters are normally connected in parallel between the receiver and the antenna.
C. Wattmeters are normally connected in parallel between the transmitter and the antenna.
D. To prevent damage to the meter, you should always set the meter to a lower range than you expect to measure.
E. You should apply power to the meter first and then select the meter range.

10. What is the input power to the tube in a final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that is operating under the following conditions?

Plate voltage = 800 volts.
Plate current = 150 milliamperes.
Screen voltage = 500 volts.
Screen current = 20 milliamperes.
Driving power = 2 watts.
Filament voltage = 12 volts.
Filament current = 2 amperes.

A. 120 watts.
B. 130 watts.
C. 122 watts.
D. 156 watts.
E. 132 watts.

11. Which of the following is the first step you should do to properly tuneup a transmitter?

A. Adjust the Load control to its minimum setting.
B. Key the transmitter and quickly adjust the Tune control for a dip.
C. Connect a dummy load to the transmitter.
D. Adjust the Drive control for the proper amount of drive.
E. Adjust the Load control for the rated plate current.

12. Which of the following is an acceptable method of checking for the radiation of harmonics?

A. Have a friend listen on frequencies that are two and three times higher than your operating frequency.
B. Have a friend listen on frequencies that are 1/2 and 1/3 of your operating frequency.
C. Wait until someone notifies you that you are radiating harmonics.
D. Have a friend listen on your operating frequency.
E. None of the above.

13. Which of the following would not help to reduce unwanted harmonics?

A. Proper shielding.
B. Maximum grid drive.
C. A transmatch or low-pass filter between the transmitter and antenna.
D. An antenna that is resonant only at the operating frequency.
E. Minimum grid drive.

14. Which of the following would help prevent electrical shock?

A. Grounded power cables.
B. Keeping antennas and transmission lines away from power lines.
C. Equipment that is not exposed to accidental contact.
D. Equipment that contains a power transformer.
E. All of the above.

15. Which of the following is the **best** method of preventing lightning damage to your equipment?

A. Cease operating during a lightning storm.
B. Use a low antenna.
C. Disconnect the antenna from your equipment during a lightning storm.
D. Disconnect the antenna from your equipment and then ground the antenna.
E. Ground your equipment.

PRETEST ANSWERS

Q	A	FRAME NO.
1.	A	(1)
2.	A	(2)
3.	C	(4)
4.	E	(7)
5.	B	(10)
6.	A	(13)
7.	B	(16)
8.	D	(19)
9.	C	(22)
10.	E	(25)
11.	C	(28)
12.	A	(31)
13.	B	(34)
14.	E	(37)
15.	D	(40)

INTRODUCTION

This module, titled "Radio Communication Practices," deals mostly with test instruments and methods of checking your equipment for proper operation. You will learn how to connect and use the basic types of meters in typical circuits. You will also learn how to check your transmitter for undesirable conditions that could interfere with other receivers.

The subject of safety is covered so you can reduce the possibility of injury to yourself or damage to your equipment.

PROGRAMMED INSTRUCTION

1. **A metal pipe which is driven into the ground to make an electrical connection to the earth is called a "ground rod."**

   Ground rods are usually made of copper or steel. Copper, however, is preferred because it is a better conductor than steel.

   A metal pipe which is driven into the ground to make an electrical connection to the earth is called a _____ _____.

ground rod

2. **A metallic object which has zero voltage with respect to the earth is said to have a "ground potential."**

   Many circuits use the metal chassis upon which they are built as a common connection. This common connection is considered "ground" and could be connected to an earth ground without affecting the circuit. In many cases, the chassis is used as the negative (−) side of the circuit.

   A metallic object which has zero voltage with respect to the earth is said to have a _____ _____.

ground potential.

3. What is a metal pipe which is driven into the ground to make an electrical connection to the earth called?

   A. A common connection.
   B. A ground rod.
   C. A ground potential.
   D. An electrical rod.
   E. A common ground.

B

4. The external circuit that is connected between the plate and the cathode of a tube is called the "plate circuit."

An amplifier plate circuit usually consists of a "load," which can be a component or another circuit, and a power supply.

Figure 9-1 shows a basic tube amplifier circuit. The plate circuit is shown in heavy lines.

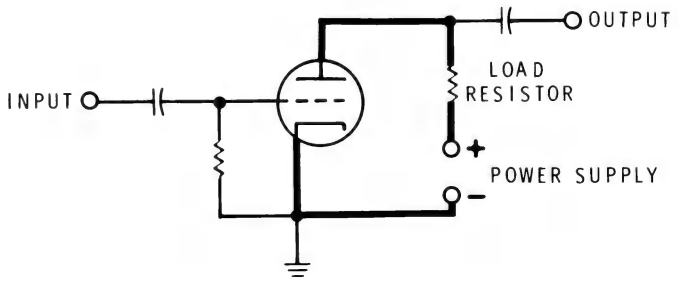


Figure 9-1

The external circuit that is connected between the plate and the cathode of a tube is called the _____ _____.

plate circuit

5. A metallic object which has a zero voltage with respect to the earth is said to have which of the following?

A. A negative potential.
B. A positive potential.
C. A zero potential.
D. A ground potential.
E. None of the above.

D

6. Which of the following best describes a ground rod?

A. A ground rod is a metal pipe which is driven into the ground to make an electrical connection to the earth.
B. A ground rod is a metal pipe which is attached to a roof for lightning protection.
C. A ground rod is a non-metallic pipe which is driven into the ground to make an electrical connection to the earth.
D. A ground rod is a non-metallic pipe which is attached to a roof for lightning protection.
E. None of the above.

A

7. One of the major problems that hams have at one time or another is interference with a neighbor's radio or television set.

The main causes of interference are improperly adjusted transmitters and poor equipment design (either the transmitter or receiver).

The first step in curing an interference problem is to check the transmitter to make sure it is adjusted properly and is operating into the proper antenna.

The second step is to determine if it is your transmitter or the neighbor's receiver which is at fault. You can check this by operating a receiver of good design near your transmitter. If you do not notice interference, the problem is with the neighbor's receiver. If you do notice a problem, the transmitter is probably at fault.

To cure a transmitter problem, install a low-pass filter between the transmitter and the antenna. Always install a low-pass filter as close to the transmitter as practical.

To cure a receiver problem, the neighbor should install a high-pass filter between his receiver and its antenna. Again, this filter should be as close to the receiver as possible. NOTE: Never install a filter on a neighbor's receiver yourself, as he may blame you for any problems that appear later.

To cure an interference problem, check the _____ for proper adjustment, install a _____-pass filter at the transmitter, install a _____-pass filter at the receiver.

transmitter low high

8. What is the external circuit that is connected between the plate and the cathode of a tube called?

A. The cathode circuit.
B. The plate circuit.
C. The plate-cathode circuit.
D. The grid circuit.
E. The input circuit.

B

9. Which of the following best describes a ground potential?

A. A ground potential is a term given a metallic object which has zero voltage with respect to earth.
B. A ground potential is a term given a non-metallic object which has zero voltage with respect to the earth.
C. A ground potential is a term given a metallic object which has a negative potential.
D. A ground potential is a term given a metallic object which has a positive potential.
E. None of the above.

A

10. **The transmission of harmonics, multiples of the desired frequency, is called "harmonic radiation."**

Usually, harmonic radiation is caused by an improperly adjusted transmitter. To guard against harmonic radiation, use the proper antenna for your operating frequency or install a transmatch (also called an antenna tuner or a matchbox) between your transmitter and antenna. Refer to Module 8 for information about antenna design and the use of a transmatch.

The transmission of harmonics, multiples of the desired frequency, is called _____ _____.

harmonic radiation

11. Which of the following would help cure an interference problem?

A. Install a low-pass filter at the transmitter.
B. Install a high-pass filter at the receiver being interfered with.
C. Check your transmitter for proper adjustment.
D. Use proper equipment design.
E. All of the above.

E

12. Which of the following best describes a plate circuit?

A. A plate circuit is the internal circuit that is connected between the plate and the cathode of a tube.
B. A plate circuit is the external circuit that is connected between the plate and the grid of the tube.
C. A plate circuit is the external circuit that is connected between the plate and the cathode of a tube.
D. A plate circuit is the internal circuit that is connected between the plate and the grid of a tube.
E. A plate circuit is the external circuit that is connected between the grid and the cathode of a tube.

C

13. **A voltmeter is always connected in parallel with the component you wish to measure the voltage across. Also, the polarity of the meter must match the polarity of the voltage across the component.**

Figure 9-2 shows a voltmeter properly connected in a circuit to measure the voltage across resistor R_1.

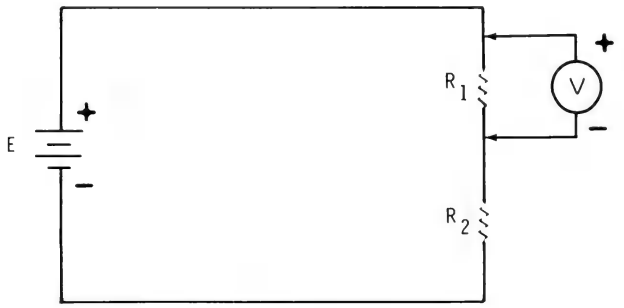


Figure 9-2

As with any meter, you should always set the meter to a higher range than what you expect to measure before you connect the meter leads.

A voltmeter is always connected in _____ with the component you wish to measure the voltage across. Also, the polarity of the meter must _____ the polarity of the voltage across the component.

parallel match

14. What is the transmission of harmonics, multiples of the desired frequency, called?

A. Multiple radiation.
B. Oscillation.
C. Multiple transmission.
D. Harmonic radiation.
E. None of the above.

D

15. Which of the following would **not** help prevent interference with a neighbor's radio or television?

A. A transmatch on the neighbor's receiver.
B. A low-pass filter on the transmitter.
C. A high-pass filter on the neighbor's receiver.
D. Proper transmitter design.
E. Proper transmitter adjustment.

A

16. **An ammeter is always connected in series with the circuit you wish to measure the current in. The meter must be connected so its positive (+) terminal is toward the positive battery terminal.**

Figure 9-3 shows an ammeter properly connected in a circuit to measure the current through the circuit.

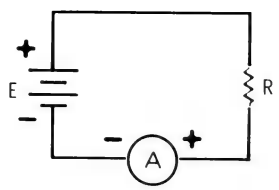
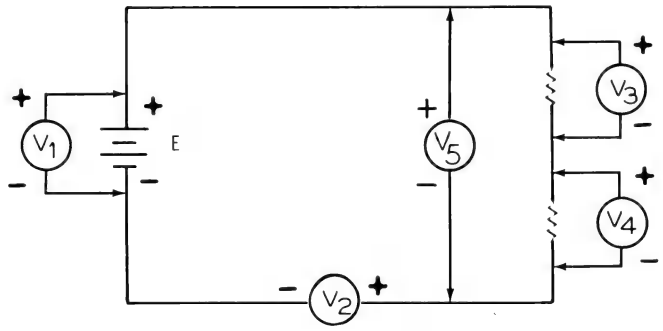


Figure 9-3

An ammeter is always connected in _____ with the circuit you wish to measure the current in. The meter must be connected so its positive terminal is _____ the positive battery terminal.

series toward

17. Which voltmeter is **not** connected properly in the following circuit?



A. V_1.
B. V_2.
C. V_3.
D. V_4.
E. V_5.

B

18. Which of the following best describes harmonic radiation?

A. Harmonic radiation is the reception of undesired frequencies.
B. Harmonic radiation is the reception of desired frequencies.
C. Harmonic radiation is the transmission of undesired multiples of a frequency.
D. Harmonic radiation is the transmission of undesired fractions of a frequency.
E. None of the above.

C

19. **An ohmmeter is always connected in parallel with the circuit or component you wish to measure the resistance of. NOTE: An ohmmeter must never be connected into a circuit that has voltage applied to it.**

Figure 9-4 shows an ohmmeter properly connected to measure a resistor in a circuit.

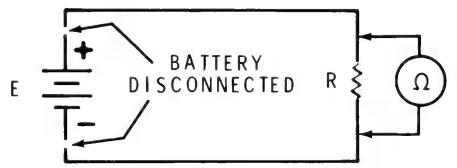
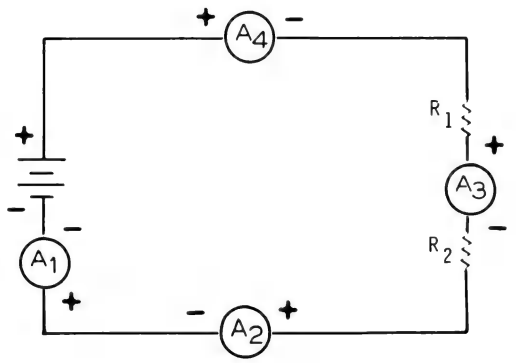


Figure 9-4

An ohmmeter is always connected in _____ with the circuit or component you wish to measure the resistance of. NOTE: An ohmmeter must never be connected into a circuit that has _____ applied to it.

parallel voltage

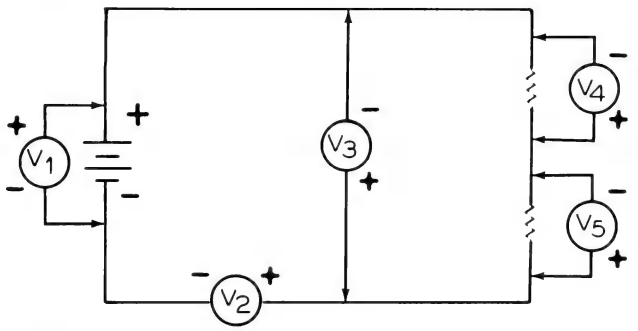
20. Which ammeter is **not** connected properly in the following circuit?



A. A_1.
B. A_2.
C. A_3.
D. A_4.
E. All meters are connected properly.

E

21. Which voltmeter in the following circuit is connected properly?



A. V_1.
B. V_2.
C. V_3.
D. V_4.
E. V_5.

A

22. There are many types of wattmeters available that you can use to measure the output of your transmitter.

Wattmeters are normally connected in parallel between the transmitter and antenna. To prevent damage to the meter, always set the meter to a higher range than what you expect to measure before you apply power to the meter.

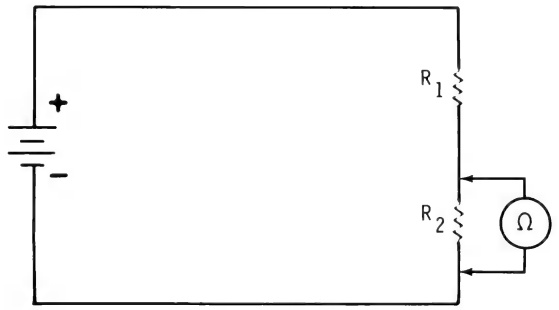
Many wattmeters have a switch so you can measure both forward power (the power going toward the antenna) and reflected power (the power coming back from the antenna, due to a mismatch). You can use these power readings to determine the SWR (standing-wave ratio) of your antenna.

This process is covered in more detail in the following section titled "Operating Aids."

Wattmeters are normally connected in _____ between the transmitter and antenna. To prevent damage to the meter, always set the meter to a _____ range than what you expect to measure before you apply power to the meter.

parallel higher

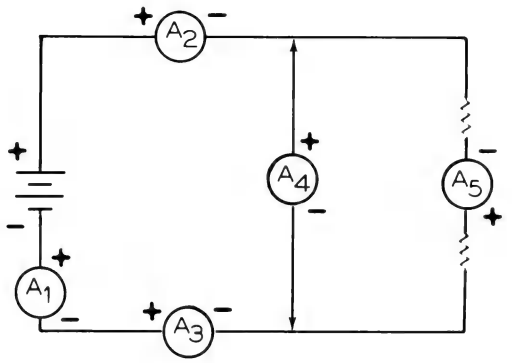
23. What is wrong in the following circuit where the resistance of resistor R_2 is being measured?



A. The battery polarity is wrong.
B. The meter should be connected in parallel with resistor R_1.
C. The meter should be connected in series with resistor R_2.
D. The battery should be disconnected from the circuit.
E. Nothing is wrong with the circuit.

D

24. Which ammeter in the following circuit is connected properly?



A. A_1.
B. A_2.
C. A_3.
D. A_4.
E. A_5.

B

25. Transmitter power, as far as an amateur transmitter is concerned, is actually the amount of **input** power to the final amplifier stage. Input power is always greater than the output power (the power coupled to the antenna). In transistor circuits, however, these power levels are much closer than in tube circuits because transistors are more efficient than tubes.

To determine the amount of input power to the final amplifier stage of a transmitter, you must add the values of plate power, screen (grid) power, and driving power (the power from the previous stage).

EXAMPLE: What is the input power to the tube in a final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that has the following operating conditions:

Plate voltage = 800 volts.
Plate current = 200 milliampers (.200 amperes).
Screen voltage = 150 volts.
Screen current = 10 milliampers (.010 amperes).
Filament voltage = 6.3 volts.
Driving power = .75 watts.

Solution: Input power = plate power + screen power + driving power.

Input power = 800 × .2 amperes = 160 watts.
150 volts × .01 amperes = 1.5 watts.
Driving power = .75 watts.

Input power = 160 + 1.5 + .75
Input power = 162.25 watts (answer)

To determine the input power to the final amplifier stage of a transmitter, you must add the amounts of _____ power, _____ power, and _____ power.

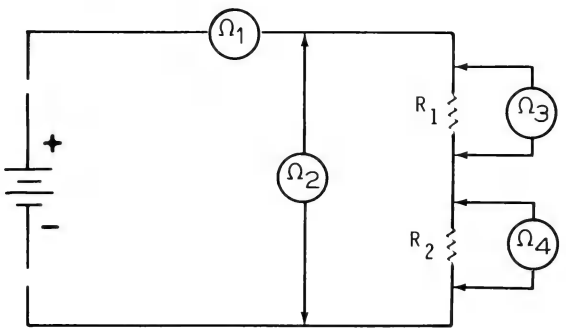
plate screen driving

26. Which of the following statements concerning wattmeters is true?

A. Wattmeters are normally connected in parallel between the transmitter and antenna.
B. Wattmeters are normally connected in parallel between the receiver and antenna.
C. Wattmeters are normally connected in series between the transmitter and antenna.
D. To prevent damage to the meter, you should always set the meter to a lower range than you expect to measure.
E. You should apply power to the meter first and then select the meter range.

A

27. Which ohmmeter is connected properly in the following circuit to measure the resistance of resistor R_1?



A. Ω_1.
B. Ω_2.
C. Ω_3.
D. Ω_4.
E. None of the meters are connected properly.

C

28. Most transmitters must be "tuned up" for best efficiency on a given frequency before you operate them. The following steps give you a generalized procedure for tuning up a transmitter. You must first determine the proper drive and plate current levels for the specific transmitter involved before you attempt this procedure. Refer to the manual supplied with your transmitter for more information.

1. Connect a dummy load to the transmitter antenna connector.
2. Adjust the Load control to its minimum setting (maximum capacitance).
3. Adjust the Drive control to the proper setting.
4. Key the transmitter and quickly adjust the Tune control for a dip (minimum plate current).
5. Adjust the Load control for rated plate current for the specific transmitter.
6. Again, adjust the Tune control for a dip.
7. Repeat steps 5 and 6 several times until the plate current indicates the specified plate current upon completion of step 6 (fully loaded).
8. Release the key.

Now, you can replace the dummy load with the antenna and operate the transmitter.

1. Connect a _____ load to the transmitter antenna connector.
2. Adjust the Load control to its _____ setting.
3. Adjust the _____ control for the proper amount of drive.
4. Key the transmitter and quickly adjust the Tune control for a _____.
5. Adjust the Load control for rated _____ current.
6. Readjust the Tune control for a _____.
7. Repeat steps _____ and _____ until the plate current indicates the specified plate current upon completion of step 6.
8. Release the _____.

dummy
minimum
Drive
dip
plate
dip
5, 6
key

29. What is the input power to the tube in the final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that is operating under the following conditions? _____.

Plate voltage = 400 volts.
Plate current = 150 milliamperes (.15 ampere).
Screen voltage = 100 volts.
Screen current = 5 milliamperes (.005 ampere).
Filament voltage = 12 volts.
Filament current = 1 ampere.
Driving power = 500 milliwatts (.5 watt).

61 watts (60 watts + .5 watt + .5 watt)

30. Which of the following statements concerning wattmeters is true?

A. Wattmeters are normally connected in parallel between the transmitter and antenna.
B. You should set the meter range before you apply power.
C. To prevent damage to the meter, you should always set the meter to a higher range than you expect to measure.
D. All of the above.
E. None of the above.

D

31. As you learned earlier, harmonics are whole multiples of a given frequency. Although harmonics are sometimes useful **inside** a transmitter, amateurs do not want to **radiate** any harmonic frequencies. Radiation of harmonics can interfere with other stations.

The easiest method of checking your signal for harmonics is to have another nearby amateur listen to frequencies that are two and three times higher than your actual signal.

If the other amateur cannot hear you on the second or third harmonic, you may consider your transmitter to be free of harmonics.

The easiest method of checking your signal for harmonics is to have another nearby amateur listen to frequencies that are _____ and _____ times higher than your actual signal.

two three

32. The steps in the right hand column below are required to properly tune up a "typical transmitter." Write the letter beside these steps into the blanks in the left hand column in the correct sequence.

1.	____	A.	Adjust the Load control to its minimum setting.
2.	____	B.	Key the transmitter and quickly adjust the Tune control for a dip.
3.	____	C.	Connect a dummy load to the transmitter.
4.	____	D.	Adjust the Drive control for the proper amount of drive.
5.	____	E.	Adjust the Load control for rated plate current.
6.	____	F.	Release the key.
7.	____	G.	Readjust the Tune control for a dip.
8.	____	H.	Repeat the Load and Tune adjustments several times until the transmitter is fully loaded.

C
A
D
B
E
G
H
F

33. What is the input power to the tube in a final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that is operating under the following conditions?

Plate voltage = 500 volts.
Plate current = 175 milliamperes (.175 ampere).
Driving power = 1 watt.
Screen voltage = 300 volts.
Screen current = 20 milliamperes (.02 ampere).
Filament voltage = 6 volts.
Filament current = 2 amperes.

A. 87.5 watts.
B. 93.5 watts
C. 88.5 watts
D. 7 watts
E. 94.5 watts

E (87.5 + 1 + 6 = 94.5 watts)

34. Improper equipment design is the major cause of harmonics.

You can eliminate or reduce unwanted harmonics by following these rules:

1. **Use minimum grid drive.**
2. **Use proper shielding.**
3. **Use a transmatch or low-pass filter between the transmitter and antenna.**
4. **Use an antenna that is resonant only at the operating frequency.**

You can eliminate or reduce unwanted harmonics by following these rules:

1. Use minimum _____ drive.
2. Use proper _____.
3. Use a _____ or _____-pass filter between the transmitter and antenna.
4. Use an antenna that is resonant only at the _____ frequency.

grid
shielding
transmatch low
operating

35. Which of the following is an acceptable way of checking for the radiation of harmonics?

A. Have a friend listen on frequencies that are 1/2 and 1/3 of your operating frequency.
B. Have a friend listen on frequencies that are two and three times higher than your operating frequency.
C. Have a friend listen on your operating frequency.
D. Wait until someone notifies you that you are radiating harmonics.
E. None of the above.

B

36. Which of the following is the first step that you should do to properly tune up a transmitter?

A. Adjust the Load control to its minimum setting.
B. Key the transmitter and quickly adjust the Tune control for a dip.
C. Connect a dummy load to the transmitter.
D. Adjust the Drive control for the proper amount of drive.
E. Adjust the Load control for the rated plate current.

C

37. Amateur equipment, like any electrical equipment, always poses a shock hazard.

The following items will help to eliminate the possibility of electrical shock.

1. **Use equipment that is not exposed to accidental contact.**
2. **Use grounded (three-wire) power cords.**
3. **Use equipment that contains a power transformer.**
4. **Keep antennas and transmission lines away from power lines.**
5. **Use bleeder resistors in power supplies.**
6. **Use equipment that has a safety interlock.**

The following items will help to eliminate the possibility of electrical shock.

1. Use equipment that is not _____ to accidental contact.
2. Use _____ (three-wire) power cords.
3. Use equipment that contains a _____ _____.
4. Keep antennas and transmission lines away from _____ lines.
5. Use _____ resistors in power supplies.
6. Use equipment that has a safety _____.

exposed
grounded
power transformer
power
bleeder
interlock

38. Which of the following would help to reduce unwanted harmonics?

A. An antenna that is resonant only at the operating frequency.
B. Proper shielding.
C. A transmatch or low-pass filter between the transmitter and antenna.
D. Minimum grid drive.
E. All of the above.

E

39. Which of the following is an acceptable method of checking for the radiation of harmonics?

A. Have a friend listen on frequencies that are two and three times higher than your operating frequency.
B. Have a friend listen on frequencies that are 1/2 and 1/3 of your operating frequency.
C. Wait until someone notifies you that you are radiating harmonics.
D. Have a friend listen on your operating frequency.
E. None of the above.

A

40. One of the most potential dangers of an amateur radio installation is lightning.

The obvious prevention of lightning danger is not to operate the station during a lightning storm. This, however, only reduces the chance of the operator from being injured; it does not protect the equipment.

The best prevention of lightning damage is to disconnect the antenna from your equipment and then ground the antenna.

The easiest method of grounding an antenna is through a grounding antenna switch. Several brands of satisfactory antenna switches are available from many sources.

The best prevention of lightning damage is to _____ the antenna from your equipment and then _____ the antenna.

disconnect ground

41. Which of the following is **not** a method of preventing electrical shock?

A. Use equipment that is not exposed to accidental contact.
B. Use grounded power cords.
C. Keep antennas and transmission lines away from power lines.
D. Use equipment that does not contain a power transformer.
E. Use equipment that has a safety interlock.

D

42. Which of the following would not help to reduce unwanted harmonics?

A. Proper shielding.
B. Maximum grid drive.
C. A transmatch or low pass filter between the transmitter and antenna.
D. An antenna that is resonant only at the operating frequency.
E. Minimum grid drive.

B

43. Which of the following is the best prevention of lightning danger to equipment?

A. Disconnect the antenna during a lightning storm.
B. Cease operation during a lightning storm.
C. Disconnect the antenna from your equipment and then ground the antenna.
D. Use a low antenna.
E. Ground your equipment.

C

44. Which of the following is a good method of preventing electrical shock?

A. Use grounded power cords.
B. Keeping antennas and transmission lines away from power lines.
C. Use equipment that is not exposed to accidental contact.
D. Use equipment that contains a power transformer.
E. All of the above.

E

45. Which of the following is the best method of preventing damage to equipment?

A. Cease operating during a lightning storm.
B. Use a low antenna.
C. Disconnect the antenna from your equipment during a lightning storm.
D. Disconnect the antenna from your equipment and then ground the antenna.
E. Ground your equipment.

D.

MODULE EXAMINATION

This examination will test your knowledge of the material presented in this module. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Examination Answers" which follow.

- If you miss more than three questions, go back and re-read this whole module.
- If you have less than three incorrect answers, go back and study those frames pertaining to the questions you missed (the number in parentheses, following the correct answer, refers you to the proper frame). Then proceed to the practice examinations.

1. Which of the following best describes a ground rod?

   A. A ground rod is a metal pipe which is driven into the ground to make electrical connection to the earth.
   B. A ground rod is a metal pipe which is attached to a roof for lightning protection.
   C. A ground rod is a non-metallic pipe which is driven into the ground to make an electrical connection to the earth.
   D. A ground rod is a non-metallic pipe which is attached to a roof for lightning protection.
   E. None of the above.

2. Which of the following describes a ground potential?

   A. A ground potential is a term given a metallic object which has zero voltage with respect to the earth.
   B. A ground potential is a term given a non-metallic object which has zero voltage with respect to the earth.
   C. A ground potential is a term given a metallic object which has a negative potential.
   D. A ground potential is a term given a metallic object which has a positive potential.
   E. None of the above.

3. Which of the following best describes a "plate circuit?"

   A. A plate circuit is the internal circuit that is connected between the plate and the cathode of a tube.
   B. A plate circuit is the external circuit that is connected between the plate and the grid of a tube.
   C. A plate circuit is the external circuit that is connected between the plate and the cathode of a tube.
   D. A plate circuit is the internal circuit that is connected between the plate and the grid of a tube.
   E. A plate circuit is the external circuit that is connected between the grid and the cathode of a tube.

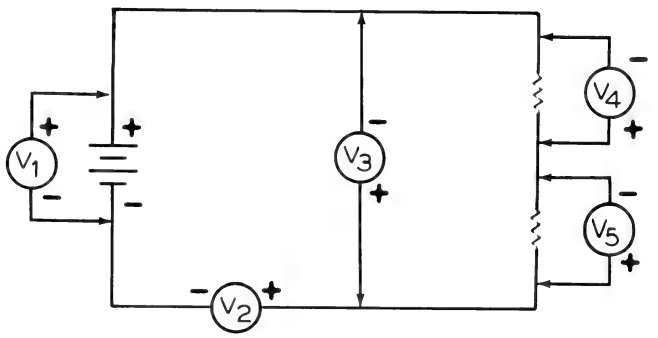
4. Which of the following would help prevent interference caused by your transmitter?

   A. Install a low-pass filter at the transmitter.
   B. Install a high-pass filter at the receiver being interfered with.
   C. Check your transmitter for proper adjustment.
   D. Use equipment of good design.
   E. All of the above.

5. Which of the following best describes harmonic radiation?

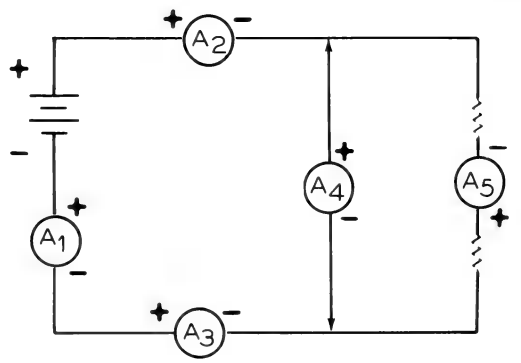
   A. Harmonic radiation is the reception of undesired frequencies.
   B. Harmonic radiation is the transmission of undesired multiples of a frequency.
   C. Harmonic radiation is the reception of desired frequencies.
   D. Harmonic radiation is the transmission of undesired fractions of a frequency.
   E. None of the above.

6. Which voltmeter in the following circuit is connected properly?



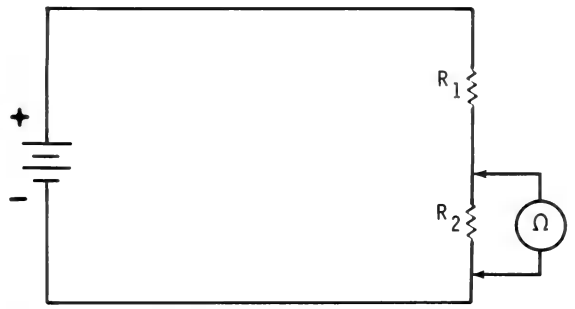
A. V_1.
B. V_2.
C. V_3.
D. V_4.
E. V_5.

7. Which ammeter in the following circuit is connected properly?



A. A_1.
B. A_2.
C. A_3.
D. A_4.
E. A_5.

8. What is wrong in the following circuit where the resistance of R_2 is being measured?



A. The battery polarity is wrong.
B. The meter should be connected in parallel with resistor R_1.
C. The meter should be connected in series with resistor R_2.
D. The battery should be disconnected from the circuit.
E. Nothing is wrong with the circuit.

9. Which of the following statements concerning wattmeters is true?

A. Wattmeters are normally connected in series between the transmitter and the antenna.
B. Wattmeters are normally connected in parallel between the receiver and the antenna.
C. Wattmeters are normally connected in parallel between the transmitter and the antenna.
D. To prevent damage to the meter, you should always set the meter to a lower range than you expect to measure.
E. You should apply power to the meter first and then select the meter range.

10. What is the input power to the tube in a final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that is operating under the following conditions?

Plate voltage = 800 volts.
Plate current = 150 milliamperes.
Screen voltage = 500 volts.
Screen current = 20 milliamperes.
Driving power = 2 watts.
Filament voltage = 12 volts.
Filament current = 2 amperes.

A. 120 watts.
B. 130 watts.
C. 122 watts.
D. 156 watts.
E. 132 watts.

11. Which of the following is the first step you should do to properly tuneup a transmitter?

A. Adjust the Load control to its minimum setting.
B. Key the transmitter and quickly adjust the Tune control for a dip.
C. Connect a dummy load to the transmitter.
D. Adjust the Drive control for the proper amount of drive.
E. Adjust the Load control for the rated plate current.

12. Which of the following is an acceptable method of checking for the radiation of harmonics?

A. Have a friend listen on frequencies that are two and three times higher than your operating frequency.
B. Have a friend listen on frequencies that are 1/2 and 1/3 of your operating frequency.
C. Wait until someone notifies you that you are radiating harmonics?
D. Have a friend listen on your operating frequency.
E. None of the above.

13. Which of the following would not help to reduce unwanted harmonics?

A. Proper shielding.
B. Maximum grid drive.
C. A transmatch or low-pass filter between the transmitter and antenna.
D. An antenna that is resonant only at the operating frequency.
E. Minimum grid drive.

14. Which of the following would help prevent electrical shock?

A. Grounded power cables.
B. Keep antennas and transmission lines away from power lines.
C. Equipment that is not exposed to accidental contact.
D. Equipment that contains a power transformer.
E. All of the above.

15. Which of the following is the **best** method of preventing lightning damage to your equipment?

A. Cease operating during a lightning storm.
B. Use a low antenna.
C. Disconnect the antenna from your equipment during a lightning storm.
D. Disconnect the antenna from your equipment and then ground the antenna.
E. Ground your equipment.

EXAMINATION ANSWERS

Q	A	FRAME NO.
1.	A	(1)
2.	A	(2)
3.	C	(4)
4.	E	(7)
5.	B	(10)
6.	A	(13)
7.	B	(16)
8.	D	(19)
9.	C	(22)
10.	E	(25)
11.	C	(28)
12.	A	(31)
13.	B	(34)
14.	E	(37)
15.	D	(40)

PRACTICE EXAMINATIONS

These practice examinations will test your knowledge of the material presented in Modules 1 through 9. For each question, circle the multiple choice answer (A, B, C, D, or E) you feel is most correct. When you have completed these questions, compare your answers with the correct ones that appear under "Practice Examination Answers" which follows. After you check your answers, go back and study those frames pertaining to the questions you missed (the information in parenthesis, following the correct answer, refers you to the proper frame). Then proceed to the "Final Examination."

PRACTICE EXAMINATION #1

1. Which of the following segments is authorized for novice use?

   A. 3.7 — 3.75 MHz.
   B. 7.1 — 7.15 MHz.
   C. 21.1 — 21.2 MHz.
   D. 28.1 — 28.2 MHz.
   E. All of the above.

2. What type of emission may a novice use?

   A. A1.
   B. AØ
   C. F1.
   D. F2.
   E. F3.

3. What is the maximum power a novice may use?

   A. 1000 watts output.
   B. 250 watts output.
   C. 1000 watts input.
   D. 250 watts input.
   E. 100 watts.

4. What is the wavelength of 15,000 kHz?

A. 20 meters.
B. .2 meters.
C. 2 meters.
D. 200 meters.
E. 2000 meters.

5. What is the frequency 7100 kHz in MHz?

A. 71 MHz.
B. 7.1 MHz.
C. 710 MHz.
D. 40 MHz.
E. .71 MHz.

6. What does QRS? mean?

A. You are sending too fast.
B. Who is calling me?
C. Am I sending too fast?
D. Do you have anything for me?
E. Am I being interfered with?

7. Which of the following is the abbreviation for Universal Coordinated Time?

A. EST.
B. UTC.
C. GMT.
D. UCT.
D. Zulu.

8. What type of emission is an interrupted, unmodulated carrier wave?

A. A0.
B. A2.
C. A1.
D. F1.
E. F2.

9. Which of the following is a true statement concerning the frequency stability of an emitted carrier wave?

A. The carrier wave may vary in frequency as long as it ends up within an amateur band.
B. The carrier wave must be as constant as the state of the art permits.
C. The carrier wave may vary in frequency as long as it starts within an amateur band.
D. The carrier wave may vary in frequency as long as it stays within an amateur band.
E. None of the above.

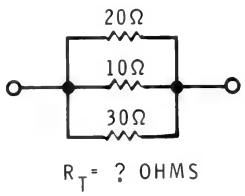
10. Select the best definition of current.

A. A difference of potential.
B. The opposition of the flow of electrons.
C. The ability to store electrical energy.
D. The amount of electrons flowing through a circuit.
E. The ability to store magnetic energy.

11. What is the unit of measurement for current?

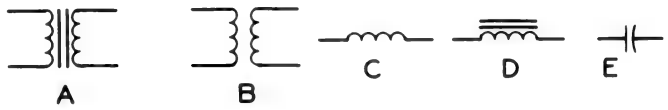
A. The watt.
B. The ohm.
C. The volt.
D. The henry.
E. The ampere.

12. What is the total resistance of the following circuit?

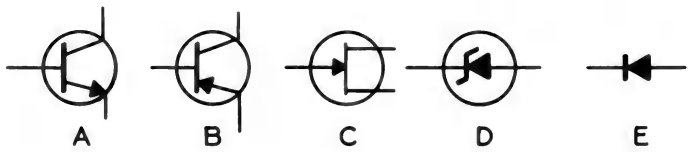


A. 60 Ω.
B. 5.45 Ω.
C. 12 Ω.
D. 7.5 Ω.
E. 6.67 Ω.

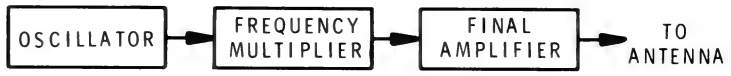
13. Select the symbol of an iron core transformer.



14. Which of the following is the symbol of a PNP transistor?

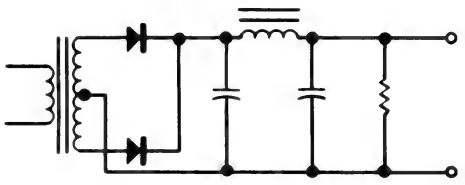


15. What does the following block diagram represent?



A. A simple receiver.
B. A key click filter.
C. A basic amplifier.
D. A simple transmitter.
E. A low-pass filter.

16. What kind of circuit is shown below?



A. A half-wave rectifier circuit.
B. A full-wave rectifier circuit.
C. A key click filter.
D. A full-wave regulator circuit.
E. An oscillator circuit.

17. Select the approximate length of a half-wave antenna suitable for use on the 15-meter novice band.

A. 15 feet.
B. 126 feet.
C. 22 feet.
D. 66 feet.
E. 11 feet.

18. The electrical length of an antenna refers to which of the following?

A. Its physical length.
B. Its length in feet.
C. Its length in yards.
D. Its length in wavelengths.
E. Its length in inches.

19. What is the input power to the tube in a final amplifier stage of a transmitter (exclusive of the power used to heat the cathode) that is operating under the following conditions?

Plate voltage = 800 volts.
Plate current = 150 milliamperes.
Screen voltage = 500 volts.
Screen current = 20 milliamperes.
Driving power = 2 watts.
Filament voltage = 12 volts.
Filament current = 2 amperes.

A. 124 watts.
B. 130 watts.
C. 122 watts.
D. 156 watts.
E. 132 watts.

20. Which of the following is the first step you should do to properly tune up a transmitter?

A. Adjust the Load control to its minimum setting.
B. Key the transmitter and quickly adjust the Tune control for a dip.
C. Connect a dummy load to the transmitter.
D. Adjust the Drive control for the proper amount of drive.
E. Adjust the Load control for the rated current.

PRACTICE EXAMINATION #2

1. How long must you retain your station log after the last entry?

   A. Five years.
   B. Six months.
   C. Two years.
   D. Indefinitely.
   E. One year.

2. How long do you have to answer a Notice of Violation?

   A. Ten hours.
   B. Two weeks.
   C. One month.
   D. Ten days.
   E. One day.

3. Which of the following is true concerning a novice license?

   A. License is good for two years, renewable.
   B. License is good for one year, non-renewable.
   C. License is good for one year, renewable.
   D. License is good for five years, renewable.
   E. License is good for two years, non-renewable.

4. What is the layer of ionized gases above the earth called.

   A. The 50-mile layer.
   B. The ionosphere.
   C. The radio region.
   D. The troposhpere.
   E. The atmosphere.

5. What is the 11-year cycle which causes changes in the layers of the ionosphere called?

   A. The atmospheric cycle.
   B. The wavelength.
   C. The sunspot cycle.
   D. The 11-year cycle.
   E. The ionosphereic cycle.

6. What is a Q signal?

A. A secret code.
B. A report of signal quality.
C. A call for any station to answer.
D. A type of abbreviation for common messages and questions.
E. A distress call.

7. Which of the following is the best signal report?

A. 599.
B. 579K.
C. 599X.
D. 599C.
E. 111.

8. Which of the following is the best place to key a transmitter?

A. A stage after the oscillator circuit.
B. The oscillator circuit.
C. A stage in front of the oscillator circuit.
D. The antenna.
E. The main power supply.

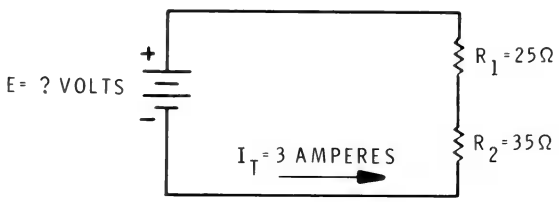
9. Which of the following is characteristic of a good quality A1 emission?

A. The emission should have many spurious emissions and a pure note.
B. The emission should be free of spurious emissions and have a pure note.
C. The emission should have many clicks and a pure note.
D. The emission should have much chirp and a pure note.
E. None of the above.

10. What is the unit of measurement for resistance?

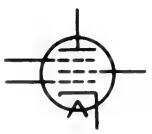
A. The farad.
B. The watt.
C. The volt.
D. The ohm.
E. The ampere.

11. What is the battery voltage in the following circuit?



A. Can't determine.
B. 105 volts.
C. 180 volts.
D. 75 volts.
E. 43.7 volts.

12. What type of tube is shown below?

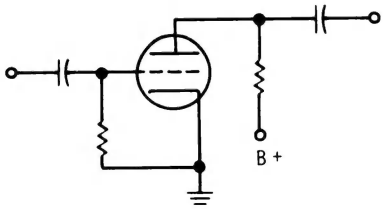


A. Pentode.
B. Triode.
C. Heptode.
D. Diode.
E. Tetrode.

13. Select the true statement concerning current flow in a vacuum tube.

A. Current flows from grid to plate.
B. Current flows from grid to cathode.
C. Current flows from plate to cathode.
D. Current flows from cathode to plate.
E. Current flows from plate to grid.

14. What kind of circuit is shown below?



A. A basic oscillator circuit.
B. A basic amplifier circuit.
C. A low-pass filter.
D. A full-wave rectifier circuit.
E. A half-wave rectifier circuit.

15. Which of the following statements is true concerning the purpose of a high-pass filter?

A. The purpose of a high-pass filter is to pass signals below a certain frequency but block higher frequency signals.
B. The purpose of a high-pass filter is to block signals above a certain frequency but pass lower frequency signals.
C. The purpose of a high-pass filter is to pass signals above a certain frequency but block signals below this frequency.
D. All of the above are true.
E. None of the above are true.

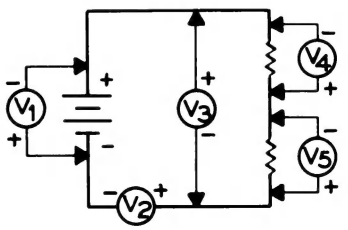
16. Select the approximate length of a half-wave antenna suitable for the 40-meter novice band.

A. 126 feet.
B. 40 feet.
C. 20 feet.
D. 33 feet.
E. 66 feet.

17. Which of the following is not a commonly used type of transmission line?

A. Zip cord.
B. Coaxial cable.
C. Ribbon wire.
D. Single wire.
E. Open-wire parallel line.

18. Which voltmeter in the following circuit is connected properly?



A. V_1.
B. V_2.
C. V_3.
D. V_4.
E. V_5.

19. Which of the following would help prevent interference caused by your transmitter?

A. Install a low-pass filter at the transmitter.
B. Install a high-pass filter at the receiver being interfered with.
C. Check your transmitter for proper adjustment.
D. Use equipment of good design.
E. All of the above.

20. Which of the following would not help to reduce unwanted harmonics?

A. The use of proper shielding.
B. The use of maximum grid drive.
C. The use of a transmatch or low-pass filter between the transmitter and antenna.
D. The use of an antenna that is resonant only at the operating frequency.
E. The use of minimum grid drive.

PRACTICE EXAMINATION ANSWERS

Examination #1

Q	A	REFERENCE
1	E	Module 1, Frames 19, 22, 25, and 28.
2	A	Module 1; Frame 31.
3	D	Module 1; Frame 34.
4	A	Module 2; Frame 37.
5	B	Module 2; Frame 16.
6	C	Module 3; Frame 10.
7	B	Module 3; Frame 49.
8	C	Module 4; Frame 19.
9	B	Module 4; Frame 31.
10	D	Module 5; Frame 1.
11	E	Module 5; Frame 43.
12	B	Module 5; Frame 73.
13	A	Module 6; Frame 10.
14	B	Module 6; Frame 22.
15	D	Module 7; Frame 4.
16	B	Module 7; Frame 22.
17	C	Module 8; Frame 25.
18	D	Module 8; Frame 1.
19	E	Module 9; Frame 25.
20	C	Module 9; Frame 28.

Examination #2

Q	A	REFERENCE
1	E	Module 1; Frame 65.
2	D	Module 1; Frame 74.
3	E	Module 1; Frame 38.
4	B	Module 2; Frame 1.
5	C	Module 2; Frame 13.
6	D	Module 3; Frame 4.
7	C	Module 3; Frame 25.
8	A	Module 4; Frame 25.
9	B	Module 4; Frame 22.
10	D	Module 5; Frame 46.
11	C	Module 5; Frame 79.
12	A	Module 6; Frame 25.
13	D	Module 6; Frame 28.
14	B	Module 7; frame 1.
15	C	Module 7; Frame 16.
16	E	Module 8; Frame 22.
17	A	Module 8; Frame 34.
18	C	Module 9; Frame 13.
19	E	Module 9; Frame 7.
20	B	Module 9; Frame 34.